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A NETWORK REVIEW
OF
MONTANA'S
AMBIENT AIR MONITORING

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ABSTRACT

This review of Montana's ambient air monitoring network: 1) shows general needs for air pollution concentration data in Montana; 2) describes representative monitoring areas relative to various stations; and 3) lists station types which meet U. S. Environmental Protection Agency criteria for collection of valid data. A short narrative for each pollutant presents the need for monitoring in specific areas based on population, source emissions and Air Quality Bureau history of pollutant concentrations. Tables list present stations and evaluate them relative to criteria for "proper" stations. Based on data needs, stations, either new or existing, are prioritized for use so equipment and funds are utilized as efficiently as is possible.

This review shows a need for increases in total suspended particulate, and carbon monoxide sampling and a decrease in sulfur dioxide monitoring. Ozone and nitrogen dioxide sampling will remain at present levels.

Implementation of May 10, 1979 Federal Register monitoring regulations generally require an increase in resources for monitoring. Some savings are achieved through elimination of unnecessary monitoring sites noted in this evaluation and review. These savings, however, will not be more than offset by the requirements for improved quality assurance, improved data handling and purchase or upgrading of equipment. With pending industrial development in Montana, the state can hardly decrease its monitoring efforts.

A. Introduction

Beginning with this report, the U.S. Environmental Protection Agency (EPA), requires Montana's Air Quality Bureau (AQB) to annually review its air monitoring program. This review will generally survey uses of air quality data in Montana, match air pollution monitoring objectives to data uses, and explain what sampling stations comprise the sampling network.

Data users in the past have used air monitoring data for stations without knowing precise information about the station's location and physical setting or what sampling procedures and quality assurance practices were applied to the data. Consequently, data applications have been questionable. For example, carbon monoxide measurements made at Missoula's busiest intersection have been assumed to be similar at other Missoula intersections. This review summarizes Montana data uses, lists reasons why the station was installed so those receiving AQB data will understand what it represents, and evaluates present and new stations for compliance with monitoring station guidelines.

Data Uses in Montana

The Air Quality Bureau (AQB) sends monthly data reports to some 30 data users. We asked these individuals to list 1) which pollutant and meteorological data they need, 2) their prioritization of pollutants, 3) which geographical areas of Montana should be monitored, 4) details for useful data formats, and 5) their reasons for receiving state air quality data. Data users include University groups, researchers, landowners, city-county, state and federal

agencies, private consulting firms, and industrial sources.

The survey showed the demand for Montana pollutant data to be:

Total Suspended Particulates	1 (most important)
Sulfur Dioxide	4
Sulfates	6
Carbon Monoxide	6
Ozone	7
Nitrogen Dioxide	7
Particle Size	8
Elemental Concentrations	9
Fluorides	9
Hydrocarbons	10
Lead	10 (least important)

Industrial sources correlated their high priority pollutants with those known to exist at their operations. And, although few listed fluorides and lead as problems, they cannot be overlooked as important Montana pollutants. Returned questionnaires showed more statewide data to be required and listed the following reasons for receiving the Bureau's data:

1. Judging attainment of national and state air quality standards.
2. Evaluating progress in achieving/maintaining national, state or local ambient air quality standards.
3. Developing or revising state implementation plans to attain/maintain ambient air standards - evaluating control strategies.
4. Review of new sources within the state.
5. Establish baseline air quality levels.
6. Provide data for model comparison and validation.
7. Support enforcement actions.
8. Document air pollution episodes and initiate emergency control measures.
9. Document population exposure and health research.

10. Provide information to:

- a. The public.
- b. Planners and decision makers for impact statement development and other uses.

With data uses known, monitoring stations (whether established or new) are reviewed to insure their collection of pollutant information which will meet data needs. Table 1 lists both general and specific objectives for air quality monitoring and data uses. Later in this review, Montana's monitoring sites will be evaluated and compared to the general monitoring objectives:

- Highest Concentration
- Population
- Source Impact
- General/Background

A site classification system that can be used to define an appropriate set of physical characteristics for each site type must examine the uses of the data in terms of the physical factors that influence the data. For example, different monitoring purposes will be associated with different geographical areas. Sometimes data is representative of a neighborhood within a city, while other data sets may represent whole city or valley stations and the data obtained from those stations.

EPA's classification system describes its spatial scale of representativeness near a monitoring station in terms of an air parcel throughout which actual pollutant concentrations are reasonably similar. The scales of representativeness are defined as follows:

1. Microscale (M) - defines the concentrations in air volumes with dimensions ranging from meters up to 100 meters (330 feet).
2. Middle scale (M) - defines the concentration typical of areas up to several city blocks in size with dimensions ranging from 100 meters to 0.5 kilometers (1650 feet).

TABLE I

RELATIONSHIP BETWEEN SITING OBJECTIVES AND DATA USES

General Monitoring Objectives	Specific Monitoring Objectives	Data Uses
A. Highest Concentration	1. Determination of Peak Concentrations in Urban and Nonurban Areas.	Judging attainment/maintenance of NAAQS. Evaluating progress in achieving/maintaining of NAAQS. Developing/revising SIPs/evaluating control strategies. Supporting enforcement actions. Public information.
	2. Emergency Episode Abatement Initiation and Monitoring.	Documenting episodes and initiating episode controls. Public information.
B. Population	1. Determination of Population Exposure in Populated Areas.	Documenting population exposure and health research. Public information.
C. Source Impact	1. Determination of the Impact of Isolated Point Sources.	Developing/revising SIPs/evaluating control strategies. Reviewing new sources. Supporting enforcement actions.
	2. Determination of the Impact of Individual Point Source in Multi-Source Urban Setting.	Developing/revising SIPs/evaluating control strategies. Reviewing new sources. Supporting enforcement actions.
D. General/Background	1. Determination of Base Concentration in Areas of Projected Growth.	Establishing baseline air quality levels for PSD planning and AQMP. Evaluating progress in achieving/maintaining NAAQS. Developing/revising SIPs to attain/maintain NAAQS. Public information.
	2. Assessment of Background Concentration in Rural Areas.	Establishing baseline air quality levels for PSD planning and AQMP. Developing/revising SIPs to attain/maintain NAAQS Public information.
	3. Diffusion Model Calibration and Refinement.	Estimation of air quality levels

3. Neighborhood scale (N) - defines concentrations within some extended (city) area which has relatively uniform land use with dimensions in the 0.5 to 4.0 kilometer (2.5 miles) range.
4. Urban scale (U) - defines the overall city or area-wide conditions with dimensions in the order of 4.0 to 50 kilometers (31 miles). This scale would usually require more than one site for definition.
5. Regional scale (R) - defines usually a rural area of reasonably homogeneous geography and extends from tens to hundreds of kilometers.
6. National and Global scales (G) - these measurement scales represent concentrations characterizing the nation and the globe as a whole.

The challenge in network design is to match station locations in terms of physical characteristics with specific monitoring objectives.

So that stations are not only comparable within the state but also nationally, EPA has devised a monitor classification system which provides guidelines for acceptable air monitoring stations.

New Stations called national air monitoring stations (NAMS), state and local air monitoring stations (SLAMS) and special purpose monitoring (SPM) stations are compared in Table II. In general the SLAMS represent major longer term state monitoring stations -- certain SLAMS sites are designated NAMS to obtain long-term data for nation-wide comparisons. Until the installation deadlines are met, the State will continue operating and upgrading its monitoring network as an interim network.

The four items listed at the bottom of Table II are extremely important and merit further consideration. First, quality assurance insures that data is complete, precise, accurate and comparable; and it is an essential part of a monitoring program. Second, monitoring methodology limits monitoring programs to the use of those

TABLE II

MAJOR STATION DESCRIPTIONS AND COMPARISONS

Monitoring Station	SLAMS	NAMS	SPM
Purpose	General program monitoring for criteria pollutants. Supplies data for state implementation plan (SIP). Needs emergency episode monitoring.	Sets national policy, obtains long-term trend data, is used in special national studies, and is selected to monitor highest pollution areas which also have high population.	Special and short-term monitoring according to Montana needs. Monitors non-criteria pollutants.
Installation Deadline	January 1, 1983	January 1, 1981	None
Review Frequency	Annual	Each third year	Annual
Relocation Frequency	Relocated or changed only on annual basis if necessary and with EPA approval.	Not to be moved	No restrictions
Data Reporting Frequencies	Beginning in 1981, annual reports due by July 1st of the following year to EPA Region and headquarters in N. Carolina.	Same	No reports due unless data is used for SIP purposes.
Report Requirements	Detailed summary, including violations of standards.	Same	None
Continuously Operating Analyzer Requirement	No, except for reference methods.	Yes, except for particulates	No
Meets requirements for:			
1. Quality Assurance	Yes	Yes	No, except for SIP*
2. Monitoring Methodology	Yes	Yes	No, except for SIP*
3. Sampling Objectives	Yes	Yes	No, except for SIP*
4. Physical Location	Yes	Yes	No, except for SIP*

*When SPM station data is used for Bureau regulatory purposes (SIP), it must meet SLAMS requirements for quality assurance, methodology, objectives and location.

methods of pollutant measurement which have been tested and are proven reliable or to which reliability can be demonstrated. Third on the list, sampling objectives must be known. And fourth, after monitoring areas are chosen, the station must be physically located to prevent interferences from local objects, to avoid vandalism and to place, where possible, air inlets at heights which represent the air breathed by people.

References in Table II to the State Implementation Plan (SIP) refer to an agreement between the State's Air Quality Bureau and the Environmental Protection Agency. This plan requires the Bureau to achieve compliance with national ambient air quality standards in Montana where they are exceeded; it also details how the Bureau will maintain clean air without violations of air standards.

The monitoring objectives referred to in Table I are reduced to four general reasons for monitoring. Table III shows the relationship among monitoring objectives and spatial scales of representativeness. Consequently, data obtained represents a geographic location.

TABLE III
RELATIONSHIP AMONG MONITORING OBJECTIVES AND SCALES OF REPRESENTATIVENESS

<u>Monitoring Objective</u>	<u>Appropriate Siting Scales</u>
Highest Concentration	Middle Neighborhood Urban (sometimes)
Population	Neighborhood
Source Impact	Middle Neighborhood Urban (sometimes)
General/Background	Neighborhood Regional

Federal criteria pollutants include: total suspended particulates (TSP), sulfur dioxide (SO_2), carbon monoxide (CO), non-methane hydrocarbons (NMHC), photochemical oxidants as ozone (O_3), nitrogen dioxide (NO_2), and lead (Pb). Table IV lists these pollutants, along with their sampling frequencies and violation levels.

All state air monitoring stations have been evaluated in preparation of this review. Based on the review process, present stations will be discontinued, relocated or upgraded and several new stations will be established. Since the physical location of stations is critical, it is necessary for the reader to realize the following background information was considered during the review process:

1. Emission inventories - detailed information, which states the pollutant types and amounts given off by a source.
2. Climatological summaries - information about the wind speeds and directions for an area with predominant winds shown on a seasonal basis, where possible.
3. Geographical material - topographical and land use maps. Photographs and population information relate geographical features to areas where people live.

Air quality data trends and Bureau judgements form the basis for most monitoring decisions in this report. All available emission inventory, modeling, meteorological and pollutant concentration data was used in compiling this review.

Company monitoring efforts are shown in this document to be extremely important. Considerable Bureau money and effort have been expended monitoring large pollutant sources. A decision is made here to limit state monitoring efforts around large pollutant sources to one source-population oriented station. The Air Quality Bureau will continue to

TABLE IV
NATIONAL AMBIENT AIR QUALITY STANDARDS

<u>Pollutant</u>	<u>Primary Standard</u>	<u>Secondary Standard</u>
Total Suspended Particulate Matter	75 $\mu\text{g}/\text{m}^3$, annual geometric mean, 260 $\mu\text{g}/\text{m}^3$, 24-hour average*	60 $\mu\text{g}/\text{m}^3$, annual geometric mean,** 150 $\mu\text{g}/\text{m}^3$, 24-hour average*
Sulfur Dioxide	80 $\mu\text{g}/\text{m}^3$ (0.03 ppm) annual arithmetic mean, 365 $\mu\text{g}/\text{m}^3$ (0.14 ppm) 24-hour average*	1300 $\mu\text{g}/\text{m}^3$ (0.5 ppm) 3-hour average*
Carbon Monoxide	9 ppm, 8-hour average* 35 ppm, 1-hour average*	Same
Nitrogen Dioxide	0.05 ppm, annual average	Same
Non-Methane Hydrocarbons	0.24 ppm, 6-9 am average**	Same
Photochemical Oxidants	.12 ppm, 1-hour average*	Same
Lead	1.5 $\mu\text{g}/\text{m}^3$, calendar quarter average	Same

*Not to be exceeded more than once per year.

** Federal guideline.

$\mu\text{g}/\text{m}^3$ - micrograms pollutant per cubic meter of sampled air.

ppm - parts pollutant per million parts of sampled air.

Primary standards were set to protect human health. Secondary standards protect public welfare and aesthetic values.

require industrial sources to monitor their operations and will supervise company monitoring programs to achieve valid data collection.

Emergency episodes occur when pollutant concentrations are high enough to cause imminent harm to human health. SLAMS and SPM stations will monitor these high concentrations. An evaluation of company SPM stations, chosen for emergency episode use, must be performed to designate them equivalent to SLAMS status. The evaluation must insure that the SPM stations conform to all State and EPA regulations for network review and quality assurance.

A perfect monitoring scheme will not be established by this review process. Montana and EPA people will annually review SLAMS stations to keep up with the changing data needs. Since it costs thousands of dollars to purchase and maintain air monitoring equipment, it is important to carefully evaluate the need for pollutant measurements in Montana. Present personnel and financial resources allow for operating fewer monitors well rather than for operating many in a shoddy manner. Therefore, monitors are evaluated so the most important data needs are met initially. As funding levels and data needs change the monitoring activities should likewise change. Many state monitors must be upgraded by 1980 to comply with EPA monitoring methodologies.

In Summary

This network review is undertaken to:

1. Determine how many stations are needed to evaluate air pollution in Montana.
2. Bring more flexibility into the State's air monitoring program.
3. Provide for timely but complete air quality data.

4. Result in valid data.

The remainder of this review will list individual pollutants, prioritized measurement locations for those pollutants, and costs needed to sustain the monitors.

B. Pollutant Analysis

I. Particulates

Particulates are Montana's most widespread pollutant. High volume (Hi-vol) air samplers measure this particulate matter which is small enough to become suspended in the ambient air and can remain suspended for hours or days. The suspended particulates are products of vehicle traffic, industrial sources and wind erosion. During inversions, suspended particulate tend to build up or ~~accum~~accumulate.

As shown in the introduction, the Bureau's greatest data need is for particulate information. This review shows some increase in statewide particulate monitoring necessary to support this data need.

Hi-vols collect particles up to about 60 micron (a human hair is about 40 microns in diameter). They operate continuously for 24 hours each sixth day - a minimum sampling frequency. Some areas affected by point sources and/or populations with histories of high TSP concentrations require greater sampling coverage and in some cases increased sample collection frequencies.

a. Population Centers - Monitoring Criteria

Table V shows past and future population figures for 52 Montana cities and towns which were considered for particulate sampling. Table VI lists the 15 highest population counties and corresponding projected populations for 1985.

For this review a county population greater than 30,000 is defined to require some level of particulate sampling; a city with a population greater than 10,000 requires particulate sampling.

Miles City and Lewistown, although less than 10,000, should have population oriented particulate samplers. Lewistown is situated in the geographic

TABLE V

POPULATION: CITY AND TOWNS

Figure No.*	City	TSP Non-Attainment**	1970	1985 est.	Projected Change 85-70
1	Billings	x	61581	87050	25469
2	Great Falls	x	60091	65100	5090
3	Missoula	x	29497	33300	3803
4	Butte	x	23368	22850	-518
5	Helena		22730	30200	7470
6	Bozeman		18670	23150	4480
7	Havre		10558	11400	842
8	Kalispell		10526	17350	6824
9	Anaconda		9771	8450	-1321
10	Miles City		9023	9950	927
11	Livingston		6883	7450	567
	Lewistown		6437	5800	363
	Glendive		6305	6150	-155
	Glasgow		4700	5300	600
	Dillon		4548	4600	52
12	Sidney		4513	4800	287
	Laurel		4454	8200	3746
	Deer Lodge		4306	5300	994
13	Libby		3286	3300	14
	Shelby		3111	2950	-161
14	Conrad		2770	3300	530
	Hardin		2733	3400	667
	Columbia Falls	x	2652	3500	848
	Hamilton		2499	3500	1001
	Polson		2464	3100	636
15	Plentywood		2381	2250	-131
	East Helena	x	1651	2250	599
	Scobey		1486	1450	-36
	Poplar		1389	1450	61
	Thompson Falls		1356	1600	244
	Ronan		1347	1550	203
	Three Forks		1188	1550	362
	Philipsburg		1128	1000	-128
	Troy		1046	1100	54
	Superior		993	1100	107

*Monitoring selected for the numbered areas. Figures in Appendix 1 show maps for each city or town.

**Non-attainment - areas where national air quality standards are exceeded.

TABLE V. Cont.
POPULATIONS: CITY AND TOWNS

Figure No.*	City	TSP Non-Attainment**	1970	1985 est.	Projected Change 85-70
16	Circle		964	1050	86
	Stevensville		829	1350	521
	Broadus		799	750	49
	Ekalaka		633	600	-63
	Lame Deer		650		
	Fort Peck		625		
	Warm Springs		500		
	Worden		425		
	Colstrip	x	120	2500	
	Ovando		120		
	Ramsay		100		
	Galen		50		
	Lindsay		40		
	Decker		30		
	Moose City				
	Polebridge				
	Spring Creek				

TABLE VI
POPULATIONS: COUNTIES

County	1970	1976	1985 est.	Projected Change 85-70
Yellowstone	87367	99600	123500	36133
Cascade	81804	83600	89000	7196
Missoula	58263	65500	74100	15837
Silver Bow	41981	41100	40700	-1281
Flathead	39460	45400	52500	13040
Gallatin	32505	37400	43700	11195
Lewis & Clark	32281	38000	44900	12619
Lincoln	18063	16400	18100	37
Hill	17358	18100	18700	1342
Deerlodge	15652	14600	13300	-2352
Lake	14445	17400	18500	4055
Ravalli	14409	18500	21400	6991
Fergus	12611	13000	13300	689
Custer	12174	13000	13400	1226
Valley	11471	13400	13100	1629

center of the state and serves an agricultural community. This central area of the state has never been measured for air pollutants.

Miles City is the largest city in the southeast portion of the state. The area around Miles City is mostly agricultural; however, several coal mines operate in nearby counties--this causes increased activity in the area. Particulate sampling is needed for geographic representation and to measure pollution trends due to development.

Due to their size, Billings, Butte, Missoula, Great Falls, Bozeman, Helena, and Kalispell all require more than one hi-vol to characterize their particulates. Maps (shown in Appendix A; numbered as in Table V) for Billings, Butte and Missoula, show TSP isopleths. These isopleths, based on modeling results, are attempts to display where particulate concentrations are similar. They generally indicate sources, high activity streets and/or commercial zones. All Appendix A maps show existing TSP monitoring sites and annual geometric means for the last three years. Newly selected monitoring areas are circled and numbered.

b. Point Sources - Monitoring Criteria

Table VII lists TSP emission rates for all major area and point sources in descending order. Selected areas for source monitors are shown on maps in Appendix A. A source with an emission rate greater than 1000 tons/year for TSP requires particulate monitoring. Seven point sources emitting less than the 1000 ton/year cut-off value will also be monitored. These are indicated in Table VII. The Bureau wishes to monitor these sources because of their impact around population centers. Past TSP readings around some of these sources have exceeded the air quality standards.

While point sources contribute large amounts of particulate matter to Montana's air, significant area source emissions are given in Table VIII (Pedco-Area Source Inventory). These particulates arise from paved and

TABLE VII

MAJOR PARTICULATE SOURCES

SOURCE	MONITOR NEEDED	TSP TON/YR	AQCR	COUNTY	CITY
Western Energy	X	> 5000	143	Rosebud	Colstrip
Peabody	X	>5000	143	Rosebud	Colstrip
Westmoreland	X	>5000	140	Bighorn	E. of Hardin
Decker Coal	X	>5000	140	Bighorn	Decker
Berkeley Pit	X	4023	142	Silver Bow	Butte
Anaconda Co. (Smelter)	X	4780	142	Deer Lodge	Anaconda
Anaconda Aluminum	X	1440	144	Flathead	Columbia Falls
Montana Power (Corette)	X	1124	140	Yellowstone	Billings
Exxon Co. U.S.A.	X	932	140	Yellowstone	Billings
Anaconda Co. (Tailing Ponds)	X	861	142	Deer Lodge	Anaconda
Hoerner-Waldorf	X	760	144	Missoula	Missoula
St. Regis Paper	X	696	144	Lincoln	Libby
Montana Power (Colstrip 1 & 2)	X	618	143	Rosebud	Colstrip
Montana-Dakota Utilities		430	143	Richland	Sidney
ASARCo Smelter	X	418	142	Lewis & Clark	East Helena
W. R. Grace Vermiculite		415	144	Lincoln	Libby
Farmers Union (CENEX)	X	398	140	Yellowstone	Laurel
Stoltz Land & Lumber		306	144	Flathead	Columbia Falls
U.S. Plywood (Bonner)		288	144	Missoula	Bonner
Continental Oil Co.		263	140	Yellowstone	Billings
Anaconda Reduction		247	141	Cascade	Great Falls
Plum Creek Lumber		213	144	Flathead	Columbia Falls
Dupois Bros. Lumber		213	144	Lake	Polson
Kaiser Cement		294	142	Jefferson	Montana City
Plum Creek Lumber		192	144	Lake	Pablo
Thompson Falls Lumber		144	144	Sanders	Thompson Falls
Ideal Cement		138	142	Gallatin	Trident
Pfizer Inc.		124	142	Beaverhead	Dillon
Holly Sugar		116	143	Richland	Sidney
Kennebec-Stevens		110	144	Lincoln	Eureka
Stauffer	X	83	142	Silver Bow	Ramsay

unpaved roads, agricultural activities, industrial sources, etc. Gallatin County without single large particulate sources ranks second high for the state indicating the rural environment experiences high particulate levels.

TABLE VIII
PARTICULATE EMISSION RATES BY COUNTY

County	Tons/Yr
Flathead	83,687
Gallatin	81,132
Lewis and Clark	66,076
Missoula	54,345
Yellowstone	53,695
Ravalli	53,683
Cascade	51,529
Lake	48,455
Roosevelt	44,290
Fergus	42,225
Lincoln	36,480
Bighorn	35,092
Valley	34,956
Carbon	34,880
Powell	34,616

Eastern Montana coal mines are significant sources. These mine areas will be monitored primarily by the mining companies themselves. As shown in Table VII, a hi-vol will be operated by the state in the vicinity of each large mine. The Bureau will audit company stations to insure valid data collection.

c. Dual Purpose Monitoring

The maximum impact of point sources and population centers overlap in some cases: Billings, Butte, Great Falls, Anaconda, East Helena, Libby and Columbia Falls. Selected areas for dual purpose monitoring are indicated in Table XV in section C below.

d. Background Monitoring

The state has two area types: mountains and plains. The two area types are shown on the map of the state in Figure 17.

The Bureau has operated several background stations in eastern Montana over the past several years. Annual averages for TSP fall between 15-25 micrograms per cubic meter. Data collected near Lindsay would represent background levels in the plains area.

Background stations have been operated on a limited scale in western Montana. Annual averages at these sites also fall between 15-25 micrograms per cubic meter. The mountain region varies in terrain features, population centers, weather conditions and vegetation. A background site should be located in a valley with similar terrain and weather conditions as are found in the Butte, Missoula, and Kalispell areas. A site near Ovando in Powell County would meet the needs of a mountainous background station.

e. Co-located Particulate Sampling Sites

According to the August 7, 1978, Federal Register, sites with the highest geometric mean concentration from the previous year must be selected for co-located sampling. This second particulate sampler is used to assess data for precision.

Four agencies, including the AQB and three city-county organizations, perform field particulate sampling and should be evaluated. Some sampling sites which have recorded highest values in the past cannot be selected for co-located sampling because this review shows the sites require modification or relocation. In some cases a second sampler cannot be physically located at a site and conform to EPA co-located sampler separation distances. Table IX shows co-located particulate sampling locations needed in Montana.

TABLE IX
LOCATIONS OF CO-LOCATED SAMPLERS (TSP)

Site	Site ID#	AQCR	County	City
S. Park - Taft School	--	140	Yellowstone	Billings
Downtown Great Falls	--	141	Cascade	Great Falls
Greeley School	0160 005	142	Silver Bow	Butte
N.E. East Helena	--	142	Lewis & Clark	Helena
Courthouse Roof	1100 001	144	Missoula	Missoula

II. Sulfur Dioxide

Table X lists sulfur dioxide (SO_2) emissions for major Montana sources. The Air Quality Bureau believes that sources emitting more than 5000 tons SO_2 per year should be continuously monitored by the state and/or the industry responsible for the SO_2 emissions. Where high concentrations occur--sources exceeding state or national ambient air quality standards--the state should operate at least one monitoring site.

Spatial scales for SO_2 monitoring typically include middle, neighborhood, and regional scales. The urban scale with dimensions from 4.0 to 50 kilometers would also be applicable. The word "urban" could be confusing because it usually implies "city". The Bureau wishes to use this scale to characterize pollutant levels over a large area even though it may be sparsely populated. Therefore, urban and regional scales apply to Montana's SO_2 monitoring.

It will not be necessary to monitor SO_2 in Missoula, Butte, Bozeman or smaller towns which have no major SO_2 emitting sources.

The following network design is based mostly on Air Quality Bureau judgements since wind information is not generally available and modeling efforts have either been too specific or have not been described in detail, which would make them useful for this review.

a. Anaconda - SO_2

At present the Anaconda Company operates six continuous SO_2 stations; the State operates three. Locations for these stations are shown in Figure 18. Consistent with the Bureau's goal to decrease its monitoring effort, only the Lincoln School station in Anaconda will continue under State operation. The State's Highway Junction (Station A) and Mill Creek (Station B) sites have recorded the areas highest concentrations. The company has been asked to locate equipment at these two sites and to relay the concentration

TABLE X
SULFUR DIOXIDE EMISSION ESTIMATES FOR 1977

SOURCE	MONITOR NEEDED	SO ₂ TONS/YR	ATTAINMENT OF STANDARDS	AQCR	COUNTY	CITY
Farmer's Union (CENEX)	x	10,380	No	140	Yellowstone	Laurel
Montana Power (Corette)	x	9,986	Unknown	140	Yellowstone	Billings
Exxon Co., U.S.A.	x	9,800	Unknown	140	Yellowstone	Billings
Continental Oil Co.		3,198	Unknown	140	Yellowstone	Billings
Montana Sulfur		1,530		140	Yellowstone	Billings
Great Western Sugar		815		140	Yellowstone	Billings
Area Sources		2,007		140	--	--
Phillips Petroleum		1,807		141	Cascade	Great Falls
Westco		883		141	Glacier	Cut Bank
Area Sources		2,600		141	--	--
Anaconda Co.(smelter)	x	281,750	No	142	Deer Lodge	Anaconda
ASARCO smelter	x	14,500	No	142	Lewis&Clark	E. Helena
Stauffer		208		142	Silver Bow	Ramsay
Anaconda Co.(Berkeley)		207		142	Silver Bow	Butte
Area Sources		596		142	--	--
Montana Power						
(Colstrip 1 & 2)		5,326		143	Rosebud	Colstrip
Montana-Dakota Ut.		2,372	Unknown	143	Richland	Sidney
Holly Sugar		226		143	Richland	Sidney
Tumpane		174		143	Valley	Glasgow
Area Sources		596		143	--	--
Anaconda Aluminum		2,200	Unknown	144	Flathead	Col. Falls
W. R. Grace Vermiculite		700		144	Lincoln	E. of Libby
Hoerner-Waldorf		365		144	Missoula	Missoula
St. Regis Paper		277		144	Lincoln	Libby
U. S. Plywood (Bonner)		224		144	Missoula	Bonner
Area Sources		3,282		144	--	--

values to the AQB on a daily basis. State and EPA-loaned equipment will continue operation at the sites until quality assurance measures are developed and implemented which insure valid data collection at the Company stations.

Company sites 2 and 3 have recorded few elevated SO_2 concentrations; these can be discontinued. Site 6 at "C" Hill can be discontinued because of its high elevation and inaccessibility. Site 7 duplicates the State's Lincoln school site; it can be discontinued.

The Bureau chose seven areas where SO_2 monitoring should be performed based on SO_2 data correlations with wind data, topography and smelter emission sources. Figure 19 shows these general locations. The state will monitor in the city of Anaconda. An agreement should be obtained with the Company to insure that monitoring is done at the other locations. The town of Opportunity generally does not receive high concentrations; winds rarely blow from the copper smelter toward this town. Winds do prevail from the smelter toward the Highway Junction site. This site is directly in line between the source and Deer Lodge. There are frequent periods when smelter emissions travel north and to the southeast.

All stations used for emergency episode measurement will require a data acquisition system to report data to the State and Company.

b. East Helena - SO_2

Present air monitoring stations around the American Smelting and Refining Company (ASARCO) lead smelter are not in prevailing wind directions. However, they are effective in measuring SO_2 emissions. General slow-moving or stagnant air (rather than windy conditions) accounts for most high SO_2 concentrations measured near the smelter. Locations south of the source and just below typical inversion elevations monitor main stack emission. Stations near the plant measure low level leakage and short stack emissions; these stations measure some main stack emissions, too.

During 1976-1978 ASARCO installed pollution control equipment which limited main stack emissions to 80 tons SO_2 per day. Some low level SO_2 emissions still occur and influence areas close to the industrial complex. The company plans to vent the baghouse emissions up a proposed tall baghouse stack.

The Air Quality Bureau will reduce its present network of three SO_2 monitors to one, which will be installed in east East Helena. The company should continue monitoring at most of its present locations with two sites relocated. Company sites 1, 3, 5, 8 & 9 should be maintained for low level emissions; sites 6 and 7 should be maintained to measure emissions during inversions. Site 2 and 4 should be relocated as shown. The relocation of Company site 2 to the east places a station in the prevailing winter wind direction; various stack emissions might impact this area. Site 4 should be relocated to the southeast in the McClellan Creek drainage area. Emissions from the smelter build up in this drainage and funnel up toward Montana City. Company site 10 can be discontinued; the readings are low and affect few people. East Helena sites are shown in Figure 20.

All stations designated for emergency episode measurements will require a data acquisition system to report data to the State and the Company.

c. Laurel - SO_2

The CENEX refinery south of Laurel emits from low level sources concentrations of SO_2 which result in violations of annual, 24-hour and 3-hour national ambient air quality standards. At this refinery, emissions measured at the State's Farm site result from prevailing winds transporting SO_2 concentrations from low level refinery sources to the monitoring site. Winds prevail from the south to west-northwest directions.

The area's monitoring history requires the Farm Station to remain and to be upgraded to SLAMS status. If CENEX increases the heights of their emission stacks, the station should be relocated about one-half mile further from the refinery but in the same direction. In the future, a SPM station should be located in the south central area of Laurel to measure SO_2 concentrations reaching the population.

d. Billings- SO_2

In Billings it is difficult to determine the origin of sulfur dioxide emissions because industrial sources are fairly close to each other and wind patterns are complicated by terrain features. Sulfur dioxide has not been measured at optimal sampling locations for these Billings sources. The Air Quality Bureau and larger Billings industries will cooperate in a study which will place SPM sulfur dioxide and meteorological monitors at locations which will measure and differentiate SO_2 emissions for individual sources.

i. Montana Power (Corette)

Table X shows Montana Power Company's Corette coal-fired power plant to emit about 10,000 tons SO_2 per year. These gases escape from a 350-foot stack and frequently impact the rimrock area just east of the plant.

ii. Exxon Co. (Refinery)

Table X shows the Exxon refinery to emit about 10,000 tons SO_2 per year. These emissions, arising from relatively low-level sources, possibly impact east Billings areas close to the refinery-- SO_2 near the source has not been adequately measured before.

Other Billings sources will be measured by the network to show their SO_2 contributions to the area. Figure 21 shows approximate locations for the SPM stations which will measure SO_2 , meteorological parameters and particulates.

e. Colstrip - SO_2

Units 1 and 2 of Montana Power Company's (MPCo) coal-fired power plant emit some 5000 tons SO_2 per year. Elevated SO_2 concentrations are not expected in the town of Colstrip the gas is emitted from tall 500 foot stacks. A MPCo station will continue to operate SE of the plant. The Bureau assumes that the Northern Cheyenne will implement their own SO_2 monitoring to protect their PSD Class I reservation. The state will receive MPCo data and will oversee company quality assurance practices.

f. Other SO_2 Sources

Sulfation plates can perform low-cost estimates of SO_2 concentrations. For example: sulfation plates collected at the Farm site near CENEX can be compared to data obtained from SO_2 monitors for the same time period. Sulfation rates near other refineries like Philips 66 in Great Falls can be compared. This could provide screening information and imply the need for future SO_2 monitoring near sources.

g. Background SO_2

Background concentrations have been measured near Colstrip and are found to be about 1.5 part per billion. These low measurements are not important for present Bureau purposes.

III. Carbon Monoxide

Carbon Monoxide (CO) concentrations occur primarily near major roadways and intersections which exhibit traffic flow problems and where

atmospheric ventilation is poor. Thus CO is generated chiefly by automotive sources although some industries also emit CO. Table XI shows available emission inventory data for selected counties.

Middle and neighborhood scales will be used for CO measurements since concentrations of the gas are generally restricted to high traffic areas.

Violations of federal CO air standards have been found in Missoula, Great Falls and Billings. EPA requires continued monitoring in these cities.

Measured CO concentrations in Montana have never exceeded the Federal 1-hour violation level but the 8-hour standard has been exceeded on numerous occasions.

The Bureau consulted with State Highway Department officials in choosing and ranking major streets and intersections as possible CO problem areas.

Subjective considerations included: numbers of vehicles typically halted by signs or signal devices, waiting times for vehicles to pass through intersections, average daily traffic counts on streets or branches of intersections, numbers of lanes, traffic problems that result continuously or during rush traffic periods, wind behavior in the area as well as frequency and duration of inversions. The review was also subjectively based on State Highway Department "adjusted traffic" volumes, city-traffic engineer complaint histories and observations.

Table XII subjectively compares various known and potential CO problem areas in Montana. Long term CO monitors will be placed in Missoula, Great Falls and Billings. An additional monitor will be assigned to Missoula and to Billings for further survey of problems--these monitors will

TABLE XI
SOURCE OF CARBON MONOXIDE, HYDROCARBON AND
NITROGEN OXIDE EMISSIONS FOR MONTANA
TONS/YR.

<u>AQCR</u>	<u>County</u>	<u>Source Type</u>	<u>CO</u>	<u>HC</u>	<u>NO₂</u>
140	Yellowstone	Point Source	59,148	43,000	9,410
		Area Source	70,157	16,000	8,800
		Total	129,305	59,000	18,210
141	Cascade	Point Source	10,578	542	113
		Area Source	91,000	14,900	8,000
		Total	101,578	15,442	8,113
142	Silver Bow	Point Source	22	2	40
		Area Source	46,500	7,800	7,500
		Total	46,522	7,802	7,540
142	Deer Lodge	Point Source	5,007	884	Unknown
		Area Source	17,700	2,600	1,200
		Total	22,707	3,484	Unknown
142	Lewis & Clark	Point Source	46,375	248	0
		Area Source	50,400	7,100	3,900
		Total	96,775	7,348	3,900
143	Custer	Point Source	0	0	0
		Area Source	13,300	2,100	1,200
		Total	13,300	2,100	1,200
144	Missoula	Point Source	17,908	413	1,896
		Area Source	89,000	12,200	6,700
		Total	106,908	12,613	8,596

TABLE XII

COMPARISON OF MONTANA INTERSECTIONS FOR CO PROBLEMS

CITY	LOCATION	AVG. DAILY TRAFFIC* (HIGHEST INPUT ST.)	RES** CLOSE	STAGNANT AIR FREQ.	INTERSEC- TION LI- MITS TRAF.	MONITORED PRESENTLY	COMMENTS
1. Missoula	Brooks, South & Russell	20,350	Yes	Often	Always	Yes	Intersection presently at capacity. Estimated worst in state for traffic flow. Numerous violations.
2. Missoula	Russell & Broadway	21,280	Yes	Often	Often	No	Extremely long waiting periods to pass through intersection.
3. Missoula	Downtown	18,500	No	Often	Peak Periods Not	No	Traffic restricted by bridge.
4. Billings	Exposition Drive and 1st Ave.	36,000	Yes	Often	Greatly	No	4 lane road with good traffic movement. Highest avg. daily traffic for Mt. City center location.
5. Billings	27th and Montana Ave.	14,000	No	Often	Often	No	Large new shopping area.
6. Billings	24th and Central Ave.	14,000	No	Often	Peak Periods	No	
7. Billings	13th and Grand Ave.	23,000	Yes	Often	Often	No	Older shopping center area.
8. Great Falls	9th Street So. & 10th Ave. South	30,000	Yes	Rare	Often	Yes	Near large shopping center, numerous violations recorded.
9. Great Falls	Central Ave. & Bypass	20,890	Yes	Rare	Often	No	Downtown traffic restricted by bridge.
10. Helena	Lindale, Mont. Ave., Helena Ave.	19,100	No	Seldom	Peak Periods	No	Fair waiting periods during peak hours.
11. Bozeman	7th and Main	20,500	No	Often	Often	No	University traffic maintains fair flow throughout day.
12. Butte	Amherst and Harrison	19,000	No	Very Often	Peak Periods	No	Backs flow during peak periods.
13. Butte	Front and Utah	18,150	Yes	Very Often	Peak Periods	No	Backs flow during peak periods.
14. Kalispell	Main Street and Idaho	19,000	Yes	Often	Often	No	Extremely long waiting periods during summer traffic.

* Note- High traffic does not imply high CO concentrations unless traffic is restricted.

** Close residences means houses within the block which is adjacent to the intersection or road.

probably be sited for 6 months to a year at various locations. A sixth CO monitor will be used in other towns around the state for short periods (6 months to a year) beginning with Bozeman.

Sites are prioritized:

1. Missoula - Brooks, South and Russell
2. Billings - Exposition Drive
3. Great Falls - 10th Avenue South
4. Missoula - Downtown
5. Billings - 13th and Grand
6. Bozeman - 7th and Main
7. Kalispell - Main and Idaho (later)

IV. Ozone

Since ozone is the most abundant oxidant in the atmosphere, it is measured to represent a class of photochemical substances known to react on warm days with hydrocarbons and nitrogen oxides to cause smog. About five hours of hot sunny weather are needed for the photochemical oxidants to react from hydrocarbon and nitrogen oxide precursors. Consequently, high ozone readings are found down wind from precursor emissions points rather than where the hydrocarbons and oxides of nitrogen are generated.

Neighborhood, urban and regional scales are appropriate monitoring scales for ozone.

Ozone concentrations peak in hot summer months; although the AQB has seen some spring time peaks in ozone concentration. Speculation suggests these early concentrations result from upper atmospheric disturbances. Since warm weather monitoring is essential and spring time

has brought elevated concentrations, ozone should be measured in Montana from early spring until mid-fall.

Where ozone is formed from hydrocarbons and oxides of nitrogen, consideration of these pollutants is necessary in a discussion of ozone. Table XI shows high hydrocarbon (HC) emissions in the Billings area. Previous Bureau ambient monitoring has resulted in extremely high HC values for the Billings area. Projections imply these HC concentrations are higher than predicted by Billings traffic volumes and may result from refinery emissions. Moderate HC levels exist in Butte and Missoula; the Great Falls area has not been measured for HC concentration. Poor ventilation conditions in Butte and Missoula versus good meteorological mixing in Great Falls suggest man-made ozone problems in Butte and Missoula may exist. Some Butte and Missoula ozone monitoring is presently being performed by the Bureau but O_3 data gathered during warm weather is limited.

Only limited nitrogen dioxide data is available for Butte, Billings, and Missoula. NO_2 concentrations in Butte and Billings may be sufficient to contribute to the formation of photochemical oxidants.

In Billings, where several years of ozone data are available, projected O_3 concentrations based on NO_2 and HC values, are not found. This could result from ozone monitors being placed too close to precursor (HC and NO_x) emission points and not at downwind locations where sufficient reaction times were allowed for the formation of ozone.

The following areas are recommended for monitors in priority order:

1. About six miles east-northeast of Billings to measure peak ozone concentrations occurring with slow-moving stagnant air masses.
2. Butte - due to the mountains surrounding Butte which allow air to circulate within the valley and to intense low-level inversions, the monitor can be placed in the city.

3. East-northeast of Billings about 50 miles (prevailing summer winds travel 8-10 miles per hour) to obtain peak ozone concentrations resulting from Billings refinery and traffic emissions.

4. Missoula - same as Butte above.

Great Falls - a station is not recommended due to excellent meteorological mixing conditions within the area.

V. Nitrogen Dioxide

Automotive sources generate nitric oxide which transforms into nitrogen dioxide (NO_2) in about two hours reaction time. Thus one expects 9-10 a.m. NO_2 peaks downwind from rush-hour traffic areas. Nitrogen dioxide monitors should be placed somewhat at the downwind end of Montana cities to measure the additive concentrations of many traffic areas, since the cities are small enough that two hours of wind travel during stagnant air periods will allow for concentration buildups at the edge of the cities.

Counties are identified in Table XI for point sources which emit oxides of nitrogen. Yellowstone, Missoula, Cascade and Silver Bow Counties have the greatest NO_2 emissions. Except for Great Falls, due to its excellent meteorological dispersion, these areas should be monitored. Present Air Quality Bureau monitoring in Butte has obtained the highest recorded hourly ambient concentrations with Billings readings a close second. There exists no hourly NO_2 standard, although the State is proposing one. No violations of the federal annual NO_2 standard have been measured in Montana.

Based on emission data, traffic volumes and air stagnations, the following monitors are recommended in priority order:

1. Billings - east end, near the fairgrounds.
2. Butte - central city area, Hebgen Park.
3. Missoula - Lion's or Rose Park area.

VI. Other Pollutants

Fluorides

Aluminum and elemental phosphorous plants in Montana are responsible for high ambient fluoride levels near those industrial complexes. Likewise, high fluoride values have been measured in the air and vegetation near the Billings-Laurel area refineries and the Corette Power Plant. Vegetation samples high in fluoride were collected in 1978 in the Billings area.

Trends in fluoride concentrations can be followed using AQB static and vegetative sampling procedures. In the past, numerous points around fluoride emitters have been measured due to the ease with which samples could be deployed in the field. Laboratory analysis of field samples are, however, rather expensive. The AQB will continue to use these manual sampling methods, but will limit their use to essential areas to save time and money. At selected locations in each area where high concentrations occur three sampling devices should be co-located to obtain precision data.

The Glacier National Park Service requests their fluoride sampling be continued. The AQB furnishes supplies and performs laboratory analysis while the Park Service does the field work. Their network of about 15 samplers east of the aluminum smelter should be continued.

The AQB general sampling network should be limited to the sites shown in Table XIII. Some of these stations have been monitored for long periods of time while other stations were discontinued several years ago - all stations were known to record high fluoride concentrations for the respective areas. In view of Montana's newly proposed state fluoride standard for vegetation, the vegetation near given emission sources should be sampled to obtain up-to-date information.

Long-term and widespread fluoride (F) problems exist in Montana. Presently the two major sources, Anaconda Aluminum and Stauffer Chemical

Companies, emit respectively 455 and 62 tons fluorides per year. The Bureau requires these companies to monitor and report ambient F levels. Neither federal standards nor federal monitoring methods exist for fluorides. Montana is proposing its own standards and monitoring methods.

High fluoride concentrations in vegetation have caused extensive livestock loss in Montana. A better-than-once-a-month concentration (which is obtained from static samplers discussed above) value is needed. The Bureau proposes the use of dual-fluoride tape samplers to obtain four-hour to daily concentration values. Stauffer operates three such devices while the Anaconda Aluminum Company (AAC) is investigating their use. Presently AAC uses a bicarbonate-coated tube sampling method.

Sulfation Rate

Large sulfur dioxide emitting sources in Montana are presently being monitored. From Table X it can be seen that Anaconda Aluminum Company (Columbia Falls) and MDU (Sidney) SO₂ emissions may be significant but have never been measured. Sulfation plates, which are SO₂ indicators, can be set out on a monthly sampling frequency to determine whether more expensive sampling methods should be used. Calculations compare the monthly results to ambient air quality standards. Table XIII shows where sulfation plates should be used.

Lead

EPA's newly adopted lead standard requires special consideration. Montana has at least two sensitive areas where elevated lead concentrations occur. The East Helena lead smelter and the Anaconda copper smelter both emit considerable quantities of airborne metallic particulate matter. Violations of the new federal standard presently occur at the State's East Helena particulate monitor.

Table XIII

Static and Seasonal Pollutant Measurements

Location	Station	Fluoride		Sulfur compounds			
		Calcium Formate	Papers	Sodium Formate	Plate	Sulfation Vegetation*	Sulfation Plates
<u>Anaconda Aluminum</u>							
	1. Anaconda S.	X		X			X
	2. Dehlboms Res	X		X		X	X
	3. Aluminum City	X		X		X	X
	4. Feirstein	X		X		X	X
	5. Teakettle #1	X		X			X
	6. Glacier N. Park	15 (X)	stations				
<u>Stauffer Chemical</u>							
	1. ESE Sta.	X		X		X	X
	2. Mt. Power Substa.	X		X		X	X
	3. Stauffer W.	X		X		X	X
	4. Ramsay N.	X		X		X	X
	5. Durant Canyon	X		X		X	X
<u>Billings-Laurel</u>							
	1. Laurel Farm	X		X		X	X
	2. 1/4 mi. S. of Co-op	X		X		X	X
	3. Two Moon Park	X		X			X
	4. E. Conoco	X		X			X
	5. Johnson & Lockwood	X		X		X	X
	6. Exxon	X		X			X
	7. Klenck Lane	X		X			X
	8. Coburn Road	X		X		X	X
	9. Piccolo * N. Ft. Rd	X		X			X
<u>Anaconda Smelter</u>							
	1. Highway Jct	X		X			X
	2. Mill Creek	X		X			X
	3. Galen	X		X			X
	4. Warm Springs						X
	5. Fairmont	X		X			X
	6. Deer Lodge						X
	7. 3.5 mi., 11° E of N.						X
	8. 7.5 mi., 16° E of N.						X
	9. 8.0 mi., 29° E of N.						X
	10. 4.0 mi., 145° E of N.						X
<u>Great Falls</u>							
	1. Philips Ref. N.1	X		X			X
	2. Philips Ref. E.	X		X			X
<u>Sidney</u>							
	1. New site	X		X		X	X
	2. new site						X

* Samples collected according to proposed state techniques and sampled monthly during the first weeks of May, June, July, August and September.

In Anaconda, lead emission values from the smelter have not been measured; although estimates show 180 tons lead per year escape the main stack. A particulate sampler at the Highway Junction Site has not shown violation levels of the standard. However, this monitor is 2.25 miles from the smelter.

The following samplers will be integrated into the State's particulate monitoring network for the two areas:

1. South central East Helena - Hastie site.
2. East East Helena - new site.

Anaconda - three particulate monitors located at the sites listed below should be used to measure lead concentrations:

1. Lincoln School.
2. Mill Creek - present state station area.
3. Highway Jct.

VII. METEOROLOGICAL DATA

This review only generally specifies meteorological needs in Montana. Wind speed and direction data from representative meteorological stations is used for the following purposes:

1. When ambient air quality violations occur, meteorological trends are studied to determine what wind conditions allow for similar violations.
2. Near multiple pollutant emission sources, meteorological information allows wind conditions to be correlated with pollutant concentrations - thus source identification.
3. With air quality and wind data from several points, mathematical models can be adjusted or validated for general use within an area. These air quality simulation models can extend ambient concentrations from a given site to many adjacent "non-sampled" monitoring points. Models also extend concentration data over different periods of time for comparison against various averaging times.

Once general meteorological conditions in most areas are known, continued wind measurement can be tailored to the situation. For cities breathing height wind measurements are not easily made. Many small scale factors influence the environment near air quality monitors which are primarily set out to measure pollutants at heights where people breathe (for standardization purposes air inlet probes are generally established at ten feet). Without extensive meteorological networks, trees, buildings, streets and heat generated by large buildings and urban industrial operations make good population oriented wind measurements extremely difficult and hardly comparable to air monitor measurements.

Wind systems will generally be used in Montana at industrial source and major population monitoring stations. Background measurements in areas of proposed industrial developments require meteorological measurements in almost every case.

Numerous inversion periods, times when cooler air becomes trapped below warm air layers, occur in mountainous and low areas in Montana. Since these inversions trap air from several hundred to over one thousand feet above valley floor areas, they prevent air pollution from escaping areas where people live. Although little can be done to prevent inversions, understanding their reoccurrence frequency can be important. During pollution buildups, people can be advised against being outdoors and emissions can be curtailed. Temperature sounding and acoustic radar measure inversions and their frequency. Once inversions are measured for an area, it may not be necessary to continue equipment operation for long time periods.

Low visibility is correlated with the eye's inability to see contrast in distant objects. Very small suspended air-borne particulates lead to hazy air in Montana. The Bureau uses nephelometers to measure these low visibility conditions; the devices effectively measure small particulate concentrations. Industrial and vehicle combustion by-products (hydrocarbons, oxides of nitrogen), as well as small dust matter, cause the occasional "smog" seen in Montana's larger cities. A visibility standard is proposed for Montana.

Table XIV shows where various meteorological sensors are located in the state. Most measurements are presently made for special purposes. General meteorological monitoring in Montana should follow the following guidelines:

1. Special Projects - Special project meteorological monitoring

should be determined on a case-by-case analysis of the project purpose. If other meteorological data is available and representative of the area studied, this can be used.

2. Background Projects - Again background project meteorological monitoring should be determined on a case-by-case analysis. Data to be used should be representative of the area studied and the type and height of emissions. The guidelines on ambient monitoring for PSD should be followed as close as possible.
3. Source Projects - Monitoring around existing sources depends on the location of the source and also the type and height of the emissions. As a minimum, monitoring should provide precipitation, surface wind speed and direction, mixing height, stability, and temperature. Often sources are located close enough to National Weather Service (NWS) stations to allow use of that data. However, again a case-by-case review must be made of the source location to determine what is representative of the area.
4. Population Projects - In Montana population project monitoring is often conducted very near NWS stations which provide the majority of the data needs. However, additional wind systems and/or mixing height data may be necessary.

Appendix E contains guidelines for specific meteorological monitoring projects.

TABLE XIV
LOCATIONS OF METEOROLOGICAL EQUIPMENT

Site	Site ID#	AQCR	County	City	Wind	Acoustic Radar	Nephelo- Meter	Pyrheli- Meter	Pyrano- Meter	Barometric Pressure	Temp.	Dew Point
Central Park	0080 059	140	Yellowstone	Billings	X				X	X	X	X
Billings Vo-Tech	0080 302	140	Yellowstone	Billings		X						
Farm E., of CENEX	0840 009	140	Yellowstone	Laurel	X							
Lincoln School	0020 007	142	Deer Lodge	Anaconda	X				X	X	X	X
Hiway Jct.	0400 004	142	Deer Lodge	Anaconda	X	X						
Hebgen Park	0160 017	142	Silver Bow	Butte	X		X					
Microwave	0760 903	142	Jefferson	E. Helena	X							
Fort Peck	0980 001	143	McCone	Ft. Peck	X							
Fisher Butte	1360 003	143	Rosebud	Lame Deer	X							
BN site	1360 027	143	Rosebud	Colstrip	X							
Scobey #1 (Border)	0340 001	143	Daniels	Scobey	X	X	X	X	X	X	X	X
Scobey #2 (Richardson)	0340 002	143	Daniels	Scobey	X							
Kalispell Airport	0480 304	144	Flathead	Kalispell	X	X	X	X	X	X	X	X
Water Supply	0480 302	144	Flathead	Col. Falls	X				X		X	
Polebridge	0480 305	144	Flathead	Polebridge	X						X	
Polson	0820 304	144	Lake	Polson	X							
Lion's Park	1100 019	144	Missoula	Missoula	X		X		X	X	X	X
Stiegler	1100 703	144	Missoula	Missoula	X							
Olofson	1100 702	144	Missoula	Missoula	X							
U of M	1100 704	144	Missoula	Missoula	X							

C. Summary and Evaluation of Sites

Table XV includes all sites, present and future, that were considered under this network review. It lists those sites that are funded by special purpose monitoring projects. In some cases, company monitors may meet the needs and be used. Table XV gives the following information:

1. Area number--this number is an abbreviated number for the site and is used to indicate locations of sites on the maps in Appendix A.
2. Name or area description.
3. Site ID number.
4. AQCR, county and city.
5. Present site--this indicates if the site is presently in operation.
6. Pollutant or meteorological device.

7. Evaluation--the Bureau evaluated all air monitoring sites using guidelines in Appendices D and E of the August 7, 1978, Federal Register.

This column identifies the sites as follows:

- a. Those which meet the data needs without modification.
 - b. Those which could be modified.
 - c. Those which must be added.
 - d. Those which are not needed for the long term.
8. Station type--these include state and local air monitoring stations (SLAMS), special purpose monitoring (SPM), and national air monitoring stations (NAMS).
9. Monitoring objectives--these include monitoring for highest concentrations, population oriented, source oriented, and background or general.
10. Spatial scale--these include microscale, middle scale, neighborhood scale, urban scale and regional scale.
11. Non-attainment area--this indicates those areas that have been designated non-attainment for a particular pollutant.

TABLE XV-A

EVALUATION

MONITORING
OBJECTIVESPATIAL
SCALESUMMARY AND EVALUATION OF AIR MONITORING
AND METEOROLOGICAL STATIONS

SUMMARY AND EVALUATION OF AIR MONITORING AND METEOROLOGICAL STATIONS																						
AREA#	NAME OR AREA DESCRIPTION	SITE ID#	AOCR	COUNTY	CITY	PRESENT SITE	POLLUTANT OR MET. DEVICE	MEETS NEEDS	MODIF. NEEDED	NEW SITE	NOT NEEDED	STATION TYPE	HIGHEST CONC.	POPULATION (P)	SOURCE (S)	BACKGROUND (B)	MICRO	MIDDLE	NEIGHBORHOOD	URBAN	REGIONAL	NON-ATTAINMENT AREA
B1g-1	City Hall	0080 008	140	Y1st	Blgs	X	TSP		X			SLAMS	X	X					X			X
B1g-1	Downtown Billings		"	"	"		CO			X		SPM	X	X				X				X
B1g-2	Grand Avenue School	0080 009	"	"	"	X	TSP	X				SLAMS		X					X			
B1g-3	Bench School	0080 028	"	"	"	X	TSP	X				SLAMS		X					X			
B1g-4	S. Park-Taft School		"	"	"		TSP			X		NAMS		X	X				X			
B1g-4	S. Park - Taft School(Co-Lo)		"	"	"		TSP			X		NAMS		X	X				X			
B1g-4	S. Park - Taft School		"	"	"		SO ₂			X		NAMS		X	X				X			
B1g-4	S. Park - Taft School		"	"	"		WIND			X		SPM		X	X					X		
B1g-5	Coburn Road		"	"	"		TSP			X		SPM		X	X				X			
B1g-5	Coburn Road		"	"	"		SO ₂			X		SPM		X	X				X			
B1g-5	Coburn Road		"	"	"		WIND			X		SPM		X	X				X			
B1g-6	N. Johnson Lane		"	"	"		TSP			X		SPM		X	X				X			
B1g-6	N. Johnson Lane		"	"	"		SO ₂			X		SPM		X	X				X			
B1g-6	N. Johnson Lane		"	"	"		WIND			X		SPM		X	X				X			
B1g-7	Fairgrounds (Expo. Dr.)	0080 061	"	"	"		SO ₂			X		SLAMS		X	X				X			
B1g-7	Fairgrounds (Expo. Dr.)	0080 061	"	"	"	X	O ₃				X	--										
B1g-7	Fairgrounds (Expo. Dr.)	0080 061	"	"	"	X	CO	X				SLAMS	X						X			X
B1g-7	Fairgrounds (Expo. Dr.)	0080 061	"	"	"		NO ₂			X		SLAMS	X							X		
B1g-7	Fairgrounds (Expo. Dr.)	0080 061	"	"	"		WIND			X		SPM			X					X		
B1g-8	Lockwood School	0080 006	"	"	"	X	TSP			X		--										
B1g-8	Lockwood School	0080 006	"	"	"	X	SO ₂	X				SPM		X					X			
B1g-8	Lockwood School	0080 006	"	"	"	X	NO ₂	X				SPM		X					X			
B1g-9	Piccolo Road		"	"	"		SO ₂			X		SPM		X					X			
B1g-10	Central Billings		"	"	"		SO ₂			X		SPM		X	X				X			
B1g-11	Central Park	0080 059	"	"	"	X	TSP				X	SPM		X					X			
B1g-11	Central Park	0080 059	"	"	"	X	SO ₂	X				SPM		X	X				X			
B1g-11	Central Park	0080 059	"	"	"	X	NO ₂	X				SPM		X					X			
B1g-11	Central Park	0080 059	"	"	"	X	O ₃	X				SPM		X					X			
B1g-11	Central Park	0080 059	"	"	"	X	WIND	X				SPM				X				X		
B1g-12	13th and Grand		"	"	"		CO			X		SPM	X	X					X			
B1g-13	Hardin Interchange		"	"	"		O ₃			X		SPM		X						X		
B1g-14	KGHL	0080 007	"	"	"	X	TSP				X	--										

TABLE XV-B

TABLE XV-B						EVALUATION		MONITORING OBJECTIVE			SPATIAL SCALE										
AREA#	NAME OR AREA DESCRIPTION	SITE ID#	AQCR	COUNTY	CITY	PRESENT SITE	POLLUTANT OR MET. DEVICE	MEETS NEEDS	MODIF. NEEDED	NEW SITE	NOT NEEDED	STATION TYPE	HIGHEST CONC. (H)	POPULATION (P)	SOURCE (S)	BACKGROUND (B)	MICRO	MIDDLE NEIGHBORHOOD	URBAN	REGIONAL	NON-ATTAINMENT AREA
Lrl-1	Farm Site	0840 009	140	Y1st	Lrl	X	TSP	X		X		SPM	X	X				X			
Lrl-1	Farm Site	0840 009	"	"	"	X	SO ₂	X				SLAMS	X	X				X			X
Lrl-1	Farm Site	0840 009	"	"	"	X	WIND	X				SPM	X	X				X			
Lrl-2	Laurel Jr. High	0840 001	"	"	"	X	TSP	X				SPM	X	X				X		X	
Cus-1	Custer	"	"	"	Cus	X	O ₃		X			SPM	X	X				X			
Dkr-1	Decker (Morton Ranch)	0060 009	"	BgHn	Dkr	X	TSP		X			SLAMS	X	X				X			
Hrd-1	Westmoreland	"	"	"	Hrd	X	TSP			X		SLAMS	X	X				X			
Hrd-2	Warren Ranch	0060 010	"	"	Hrd	X	TSP				X	--									
Lew-1	Central Lewistown	"	"	Frgs	Lew		TSP			X		SPM	X					X			
Gtf-1	Downtown Great Falls		141	Cscd	Gtf		TSP	X		X		NAMS	X	X				X			X
Gtf-1	Downtown Great Falls (Co-1o)	"	"	"	"		TSP	X		X		NAMS	X	X				X			
Gtf-1	Downtown Great Falls	"	"	"	"		WIND			X		SPM			X				X		
Gtf-2	North of 10th Avenue South	"	"	"	"		TSP			X		SLAMS	X	X				X			
Gtf-3	N. Kiwanis Park	"	"	"	"	X	TSP	X				SPM	X	X				X			
Gtf-4	NW Missouri River	"	"	"	"		TSP			X		SPM	X	X				X			
Gtf-5	Black Eagle	"	"	"	"		TSP			X		SLAMS	X	X				X			
Gtf-6	10th Avenue South	0660 015	"	"	"	X	CO		X			SLAMS	X	X	X			X			X
Gtf-7	Hospital Roof	0660 007	"	"	"	X	TSP				X	--									
Gtf-8	Fire Station #1	0660 009	"	"	"	X	TSP				X	--									
Gnp-1	Glacier National Park	0570 001	"	Glcr	StM	X	TSP	X				NAMS			X				X		
Hvr-1	Central Havre	"	"	Hill	Hvr		TSP			X		SLAMS	X					X			
Ana-1	Lincoln School	0020 007	142	DrLd	Ana	X	TSP	X				SLAMS	X	X				X			
Ana-1	Lincoln School	0020 007	"	"	"	X	SO ₂		X			SLAMS	X	X				X			X
Ana-1	Lincoln School	0020 007	"	"	"	X	NO ₂	X				SPM	X	X				X			
Ana-1	Lincoln School	0020 007	"	"	"	X	O ₃	X				SPM	X	X				X			
Ana-1	Lincoln School	0020 007	"	"	"	X	WIND	X				SPM	X	X				X			
Ana-2	Hiway Jct.	0400 004	"	"	"	X	TSP	X				SLAMS	X	X				X			
Ana-2	Hiway Jct.	0400 004	"	"	"	X	SO ₂			X		--									
Ana-2	Hiway Jct.	0400 004	"	"	"	X	WIND			X		SPM	X	X				X			
Ana-3	Mill Creek	0400 012	"	"	"		TSP			X		SLAMS	X	X				X			
Ana-3	Mill Creek	0400 012	"	"	"	X	SO ₂			X		--									
Ana-4	Warm Springs-Hiway 48	"	"	"	"		TSP			X		SPM	X					X			

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TABLE XV-C

TABLE XV-C						EVALUATION					MONITORING OBJECTIVE			SPATIAL SCALE				NON-ATTAINMENT AREA			
AREA#	NAME OR AREA DESCRIPTION	SITE ID#	AQCR	COUNTY	CITY	PRESENT SITE	POLLUTANT OR MET. DEVICE	MEETS NEEDS	MODIF. NEEDED	NEW SITE	NOT NEEDED	STATION TYPE	HIGHEST CONC. (H)	POPULATION (P)	SOURCE (S)	BACKGROUND (B)	MICRO		MIDDLE	NEIGHBORHOOD	URBAN
Bte-1	Dr. Canty's Residence	0160 019	142	SlvB	Bte	X	TSP	X				SPM	X						X		
Bte-2	Floral Park F. S.	0160 020				X	TSP	X				SPM	X						X		
Bte-3	Walkerville		"	"	"		TSP			X		SPM	X	X					X		
Bte-4	Hebgen Park	0160 017	"	"	"	X	TSP	X				SLAMS	X	X					X		
Bte-4	Hebgen Park	0160 017	"	"	"		O ₃	X				SPM	X							X	
Bte-4	Hebgen Park	0160 017	"	"	"	X	SO ₂		X			SPM			X				X		
Bte-4	Hebgen Park	0160 017	"	"	"	X	NO ₂	X				SPM	X						X		
Bte-4	Hebgen Park	0160 017	"	"	"	X	WIND	X				SPM			X				X		
Bte-5	Greeley School	0160 005	"	"	"	X	TSP	X				SLAMS	X	X	X				X		X
Bte-5	Greeley (Co-lo)	0160 005					TSP			X		SLAMS	X	X	X				X		
Bte-6	Richer Res.	0160 014	"	"	"	X	TSP				X	--									
Bte-7	Alpine West	0160 015	"	"	"	X	CO				X	--									
Bzm-1	East Downtown Bozeman		"	Gltn	Bzm		TSP			X		SLAMS		X					X		
Bzm-2	S. of W. Main Street		"	"	"		TSP			X		SPM		X					X		
Bzm-3	7th and Main Street		"	"	"		CO			X		SPM		X	X				X		
Bzm-4	Traphagen Hall	0120 001	"	"	"	X	TSP				X	SPM		X					X		
Bzm-4	Traphagen Hall	0120 001	"	"	"		WIND			X		SPM			X				X		
Eh1-1	212 Pacific (Hastie)	0860 002	"	LwCk	Eh1	X	TSP		X			SLAMS		X	X				X		X
Eh1-2	E. - East Helena		"	"	"		TSP		X			SLAMS		X	X				X		
Eh1-2	E. - E. Helena (Co-lo)		"	"	"		TSP		X			SLAMS		X	X				X		
Eh1-2	E. - East Helena		"	"	"		SO ₂		X			SLAMS			X				X		X
Eh1-2	E. - East Helena		"	"	"		WIND			X		SPM			X				X		
Eh1-3	East Station	0720 011	"	"	"		SO ₂				X	--									
Eh1-4	Microwave	0760 903	"	Jfrs	"	X	TSP				X	--									
Eh1-4	Microwave	0760 903	"	"	"	X	SO ₂				X	--									
Eh1-4	Microwave	0760 903	"	"	"	X	WIND				X	--									
Eh1-5	Broudy	0760 904	"	"	"	X	SO ₂				X	--									
Hln-1	Cogswell Building	0720 001	"	LwCk	Hln	X	TSP		X			SLAMS		X					X		
Hln-2	Helena Valley		"	"	"	X	TSP			X		SPM		X					X		
Pbg-1	McKinley Residence	0640 005	"	Grnt	Pbg	X	TSP			X		--									
Ova-1	Nevada Valley		"	Powl	Ova		TSP		X			SLAMS			X					X	
Ram-1	Tierney Residence	1480 015	"	SlvB	Ram	X	TSP	X				SLAMS			X				X		

TABLE XV-D

EVALUATION

MONITORING
OBJECTIVESPATIAL
SCALE

AREA#	NAME OR AREA DESCRIPTION	SITE ID#	AOCR	COUNTY	CITY	PRESENT SITE	POLLUTANT OR MET. DEVICE	FEETS NEEDS MODIF. NEEDED	NEW SITE	NOT NEEDED	STATION TYPE	HIGHEST CONC. (H)	POPULATION (P)	SOURCE (S)	BACKGROUND (B)	MICRO	MIDDLE	NEIGHBORHOOD	URBAN	REGIONAL	NON-ATTAINMENT AREA
Lnd-1	Lindsay-Weilgosh	0360 004	143	Dwsn	Lnd	X	TSP	X			SLAMS				X					X	
Lnd-1	Lindsay-Weilgosh	0360 004	"	"	"		WIND		X		SPM				X						
Gln-1	Glendive-Micro.	0360 001	"	"	Gln	X	TSP			X	--									X	
Cls-1	Town of Colstrip		"	Rsb	Cls		TSP		X		SLAMS										
Cls-2	BN Site	1360 027	"	"	"	X	TSP	X			SLAMS				X						
Cls-2	BN Site	1360 027	"	"	"	X	WIND			X	--										
Cls-3	South of Colstrip		"	"	"		TSP		X		SPM			X					X		
Cls-4	McRae Site	1360 028	"	"	"	X	TSP	X			--										
Brd-1	Randall Ranch	1240 009	"	PwdR	Brd	X	TSP			X	--										
Ftp-1	Fort Peck	0980 001	"	McCn	Ftp	X	TSP			X	--										
Ftp-1	Fort Peck	0980 001	"	"	"	X	WIND			X	--										
Lmd-1	Fisher Butte	1360 003	"	Rsb	Lmd	X	TSP			X	--										
Lmd-1	Fisher Butte	1360 003	"	"	"	X	WIND			X	--										
Scb-1	Scobey #1 (Border)	0340 001	"	Dnls	Scb	X	TSP	X			SPM			X	X					X	
Scb-1	Scobey #1 (Border)	0340 001	"	"	"		SO ₂	X			SPM			X	X					X	
Scb-1	Scobey #1 (Border)	0340 001	"	"	"	X	WIND	X			SPM			X	X					X	
Scb-2	Scobey #2 (Richardson)	0340 002	"	"	"	X	TSP	X			SPM			X	X					X	
Scb-2	Scobey #2 (Richardson)	0340 002	"	"	"	X	WIND	X			SPM			X	X					X	
Scb-3	Scobey #3 (Engberg)	0340 003	"	"	"	X	TSP	X			SPM			X	X					X	
Mlc-1	Central Miles City		"	Cstr	Mlc		TSP		X		SPM			X				X			
Clf-1	Ander's Residence	0270 005	144	Fthd	Clf	X	TSP	X			SLAMS			X	X						
Clf-2	NAAC-(Dehlbom's)	0480 002	"	"	"	X	TSP	X			SLAMS			X				X			
Clf-3	Water Supply	0480 302	"	"	"	X	WIND	X			SPM				X						
Kal-1	Strom's Residence	0800 014	"	"	Kal	X	TSP	X			SLAMS			X							
Kal-2	Evergreen Area		"	"	"		TSP		X		SPM			X				X			
Kal-3	Kalispell Airport	0480 304	"	"	"	X	TSP	X			SPM			X				X			
Kal-3	Kalispell Airport	0480 304	"	"	"	X	WIND	X			SPM				X				X		
Msc-1	Moose City	0480 306	"	"	Msc	X	TSP	X			SPM				X				X		
Bgf-1	Big Fork		"	"	Bgf		TSP		X		SPM			X						X	
Ron-1	Ronan (Disney)	0820 011	"	Lake	Ron	X	TSP	X			SPM			X				X			
Pol-1	Polson (Trussler)	0820 010	"	"	Pol	X	WIND	X			SPM			X					X		
Pbr-1	Polebridge	0480 305	"	Fthd	Pbr	X	WIND	X			SPM			X					X		
Msl-1	Courthouse Roof	1100 001	"	Msl	Msl	X	TSP	X			SLAMS			X					X		
Msl-1	Courthouse (Co-10)	1100 001	"	"	"		TSP		X		SLAMS			X					X		

TABLE XV-E

TABLE XV-E						EVALUATION	MONITORING OBJECTIVE	SPATIAL SCALE														
AREA#	NAME OR AREA DESCRIPTION	SITE ID#	AQCR	COUNTY	CITY	PRESENT SITE	POLLUTANT OR MET. DEVICE	MEETS NEEDS	MODIF. NEEDED	NEW SITE	NOT NEEDED	STATION TYPE	HIGHEST CONC. (H)	POPULATION (P)	SOURCE (S)	BACKGROUND (B)	MICRO	MIDDLE	NEIGHBORHOOD	URBAN	REGIONAL	NON-ATTAINMENT AREA
Msl-2	Russell - S. 5th Street		144	Msla	Msl		TSP			X		SPM	X					X				X
Msl-3	McLeod Park	1100 021	"	"	"	X	TSP	X				SPM	X					X				X
Msl-4	Rose Park	1100 020	"	"	"	X	TSP	X				NAMS	X					X				X
Msl-4	Rose or Lion's Park	1100 020	"	"	"		O ₃			X		SPM	X					X				
Msl-4	Rose or Lion's Park	1100 020	"	"	"		NO ₂			X		SPM	X					X				
Msl-4	Rose or Lion's Park	1100 020	"	"	"		WIND			X		SPM			X				X			
Msl-5	Hoerner-Waldorf II	1100 016	"	"	"	X	TSP	X				SPM		X				X				
Msl-6	Malfunction Jct.	1080 003	"	"	"	X	CO	X				SLAMS	X	X				X				X
Msl-7	Downtown	"	"	"	"		CO			X		SPM	X	X				X				X
Msl-7	Downtown	"	"	"	"		WIND			X		SPM			X				X			
Msl-8	Lion's Park	1100 019	"	"	"	X	TSP	X				SPM	X					X				X
Msl-8	Lion's Park	1100 019	"	"	"	X	SO ₂	X				SPM		X				X				
Msl-8	Lion's Park	1100 019	"	"	"	X	NO ₂	X				SPM	X					X				
Msl-8	Lion's Park	1100 019	"	"	"	X	O ₃	X				SPM	X					X				
Msl-8	Lion's Park	1100 019	"	"	"	X	CO	X				SPM	X				X					
Msl-8	Lion's Park	1100 019	"	"	"	X	WIND	X				SPM			X				X			
Msl-9	Johnson Bell Field	1100 009	"	"	"	X	TSP				X	--								X		
Msl-10	Bonner I	1100 019	"	"	"	X	TSP				X	--										
Msl-11	Stiegler's	1100 703	"	"	"	X	WIND	X				SPM			X				X			
Msl-12	Olofson's	1100 702	"	"	"	X	WIND	X				SPM		X					X			
Msl-13	University of Montana	1100 704	"	"	"	X	WIND	X				SPM			X				X			
mf-1	Lodge Motel	1400 002	"	Sndr	Tmf	X	TSP				X	--										
Lib-1	Brown's Residence	0900 010	"	Lnc1	Lib	X	TSP	X				SLAMS	X	X					X			

D. Priority List of Monitoring Stations

The following Table XVI summarizes in priority order (most important monitors listed first) all monitoring stations necessary for Montana's basic ambient air monitoring program. Some special project stations are included in this list because they compliment the state program. These important special purpose stations will either operate for several years or they will be incorporated into the Bureau's general monitoring program to ensure their continued operation. Other special project stations gather data for specific monitoring efforts described in Appendix C.

This list incorporates the monitoring strategy described in the narrative, summary and evaluation sections above. Equipment exccessed by station shut-downs is designated as shown in Table XVII for stations higher on the priority list so they can become operational sooner. A blank installation date implies the station is presently operational.

Combined costs include estimations for site modifications, equivalency problems and equipment purchases. All available or relocated equipment is or will be used at high priority stations. Greater equipment costs are evident nearer the bottom of the list showing that increased funding levels will be necessary to implement lower priority monitoring.

Implementation of ambient monitoring regulations requires a net increase in resources. Some relatively minor savings will be achieved through the elimination of unnecessary monitoring sites as this review shows. These savings are more than offset by the requirements for improved quality assurance, data handling capabilities and the purchase of equivalent instruments.

Except for the NAMS SO₂ station in Billings and the Laurel-Farm SO₂ site, the Billings SO₂ monitors will be special project oriented. The Bureau will negotiate with some Billings-Laurel area industries for the purchase and operation of some six source-oriented SO₂ stations, which will gather data for about two years.

It is also noted that the Bureau's Philips SO₂ analyzers (three on loan from EPA and two owned by the Bureau) which are EPA equivalent are not satisfactory for Bureau operation for more than this first annual review period. The Philip's Company discontinued ambient air monitoring equipment production in 1978. Consequently parts and supplies, which are already very costly, will be impossible to obtain within two years. With this review the Bureau wishes to meet the EPA monitoring equivalence deadline in February of 1980.

Costs to purchase new equipment, upgrade, relocate or discontinue present air monitors and convert to EPA monitor equivalency status are listed below:

<u>Parameter</u>	<u>Network Size</u>	<u>No. Purchases (Costs)</u>	<u>No. Sta. changes (Costs)</u>	<u>Equivalency Conversion (Costs)</u>
TSP	55	14 (\$8,500)	38 (\$15,250)	0
SO ₂	5	2 (\$14,000)	4 (\$5,500)	0
CO ₂	6	2 (\$13,000)	5 (\$5,600)	4 (\$3,200)
O ₃	4	3 (\$18,000)	3 (\$2,750)	0
NO ₂	3	1 (\$7,000)	2 (\$2,050)	0
Met	10	0	4 (\$900)	--
DAS	9	5 (\$57,500)	--	--
		(\$118,000)	(\$30,950)	(\$3,200)

Table XVII shows the disposition of unneeded monitoring stations.

TABLE XVI-A

PRIORITIZED LIST FOR MONITORING STATIONS IN MONTANA

AREA #	NAME OR DESCRIPTION	POLL.	SPECIAL PROJECT FUNDED	AQCR	COUNTY	CITY	STA. TYPE	AUG. 7 F.R. COMPLIANCE DATE	NEW STATION INSTALLATION DATE	SITE MODIFICATION NEEDED	EQUIVALENCY PROBLEM
Ana-1*	Lincoln School	SO ₂	X	142	Deer Lodge	Anaconda	SLAMS	1/83		X	
Lrl-1*	Farm Site	SO ₂		140	Yellowstone	Laurel	SLAMS	1/83		X	X
Msl-4*	Rose or Lion's Park	TSP	X	144	Missoula	Missoula	NAMS	1/81			X
Msl-6	Malfunction Jct.	CO		144	Missoula	Missoula	SLAMS	1/83			
Bte-5*	Greeley School	TSP		142	Silver Bow	Butte	SLAMS	1/83			
Ana-1*	Lincoln School	MET	X	142	Deer Lodge	Anaconda	SPM				
Bte-5*	Greeley (Co-Located)	TSP		142	Silver Bow	Butte	SLAMS	1/83	10/79		
Ehl-1*	212 Pacific (Hastie)	TSP		142	Lewis & Clark	E. Helena	SLAMS	1/83		X	
Ehl-2*	East - E. Helena	SO ₂		142	Lewis & Clark	E. Helena	SLAMS	1/83	10/79		X
Blg-7*	Fairgrounds (Exposition Dr.)	CO		140	Yellowstone	Billings	SLAMS	1/83		X	X
Ehl-2*	East - E. Helena	TSP		142	Lewis & Clark	E. Helena	SLAMS	1/83	10/79		
Msl-4*	Rose or Lion's Park	MET	X	144	Missoula	Missoula	SPM				
Ehl-2*	East - E. Helena (Co-Located)	TSP		142	Lewis & Clark	E. Helena	SLAMS	1/83	10/79		
Ana-1*	Lincoln School	TSP	X	142	Deer Lodge	Anaconda	SLAMS	1/83			
Ana-3*	Mill Creek	TSP		142	Deer Lodge	Anaconda	SLAMS	1/83	7/79		
Msl-1*	Courthouse Roof	TSP		144	Missoula	Missoula	SLAMS	1/83			
Msl-1*	Courthouse Roof (Co-Located)	TSP		144	Missoula	Missoula	SLAMS	1/83	10/79		
Fhl-2*	N.E. - East Helena	MET		142	Lewis & Clark	East Helena	SPM		10/79		
Msl-7*	Downtown	CO		144	Missoula	Missoula	SPM	8/79			X
Gtf-1*	Downtown Great Falls	TSP		141	Cascade	Great Falls	NAMS	1/81	11/79		
Gtf-1*	Downtown Grt. Falls (Co-Located)	TSP		141	Cascade	Great Falls	NAMS	1/81	11/79		
Gtf-6*	10th Ave. South	CO		141	Cascade	Great Falls	SLAMS	1/83	9/79		X
Blg-13*	Hardin Interchange	O ₃		140	Yellowstone	E. of Billings	SPM		6/79		X
Gtf-1*	Downtown Great Falls	MET		141	Cascade	Great Falls	SPM		11/79		
Clf-1*	Ander's Residence	TSP		144	Flathead	Columbia Falls	SLAMS	1/83			
Clf-1*	Colstrip	TSP	X	143	Rosebud	Colstrip	SLAMS	1/83	11/79		
Bte-4*	Hebgen Park	TSP	X	142	Silver Bow	Butte	SLAMS	1/83			
Blg-1*	City Hall	TSP		140	Yellowstone	Billings	SLAMS	1/83			X
Ana-2*	Hiway Junction	TSP		142	Deer Lodge	Anaconda	SLAMS	1/83	8/79		
Bte-4*	Hebgen Park	MET		142	Silver Bow	Butte	SPM				

TABLE XVI-B

PRIORITIZED LIST FOR MONITORING STATIONS IN MONTANA

AREA #	NAME OR DESCRIPTION	POLL.	SPECIAL PROJECT FUNDED	AQCR	COUNTY	CITY	STA. TYPE	AUG. 7 F.R. COMPLIANCE DATE	NEW STATION INSTALLATION DATE	SITE MODIFICATION NEEDED	EQUIVALENCY PROBLEM
Bzm-1*	East Downtown Bozeman	TSP		142	Gallatin	Bozeman	SLAMS	1/83	10/79		
Blg-4*	South Park - Taft School	SO ₂		140	Yellowstone	Billings	NAMS	1/81	5/80		
Blg-6	No. Johnson Lane	SO ₂	X	140	Yellowstone	E. of Billings	SPM		5/80		
Kal-1*	Strom Residence	TSP		144	Flathead	Kalispell	SLAMS	1/83		X	
Cls-2*	BN Site	TSP	X	143	Rosebud	S. of Colstrip	SLAMS	1/83			
Bzm-4	Traphagen Hall	MET		142	Gallatin	Bozeman	SPM				
Bzm-3*	7th & Main Street	CO		142	Gallatin	Bozeman	SPM				X
Blg-7*	Fairgrounds (Exposition Drive)	NO ₂		140	Yellowstone	Billings	SLAMS	1/83	9/80		
Ova-1*	Nevada Valley (Ovando)	TSP		142	Powell	Ovando	SLAMS	1/83	6/80		
Bte-2*	Floral Park Fire Station	TSP	X	142	Silver Bow	Butte	SPM				
Blg-13	13th & Grand Ave.	CO		140	Yellowstone	Billings	SPM		8/80		
Blg-4*	Hebgen Park	NO ₂	X	142	Silver Bow	Butte	SLAMS	1/83			X
Lrl-1*	Farm Site	MET		140	Yellowstone	Laurel	SPM				
Lib-1*	Brown's Residence	TSP		144	Lincoln	Libby	SLAMS	1/83			
Scb-1*	Scobey #1 (Border)	SO ₂	X	143	Daniels	Scobey	SPM				
Scb-1*	Scobey #1 (Border)	NO ₂	X	143	Daniels	Scobey	SPM				
Scb-1*	Scobey #1 (Border)	TSP	X	143	Daniels	Scobey	SPM				
Cls-2	BN Site	MET		143	Rosebud	S. of Colstrip	SPM				
Msl-3*	McLeod Park	TSP	X	144	Missoula	Missoula	SLAMS	1/83			
Msl-9	Piccolo Road	SO ₂	X	140	Yellowstone	Billings	SPM		5/80		
Hvr-1*	Central Havre	TSP		141	Hill	Havre	SLAMS	1/83	6/80		
Bte-1*	Dr. Canty's Residence	TSP	X	142	Silver Bow	Butte	SPM				
Lnd-1*	Lindsay - Wielgosh	TSP	X	143	Dawson	Lindsay	SLAMS	1/83			
Lrl-2	Laurel Jr. High School	TSP		140	Yellowstone	Laurel	SPM				
Cls-3*	So. of Colstrip (Peabody)	TSP		143	Rosebud	So. of Colstrip	SPM		8/80		
Blg-2*	Grand Ave. School	TSP		140	Yellowstone	Billings	SLAMS	1/83			
Blg-4*	South Park - Taft School	TSP		140	Yellowstone	Billings	NAMS	1/81	7/80		
Blg-4*	So. Park - Taft Sch. (Co-Located)	TSP		140	Yellowstone	Billings	NAMS	1/81	7/80		
Msl-5*	Hoerner-Waldorf II	TSP	X	144	Missoula	Missoula	SPM				
Blg-4*	So. Park - Taft School	MET		140	Yellowstone	Billings	SPM				
Blg-5	Coburn Road	SO ₂	X	140	Yellowstone	Billings	SPM		5/80		
Blg-5	Coburn Road	TSP		140	Yellowstone	Billings	SPM		5/80		
Lew-1*	Central Lewistown	TSP		140	Fergus	Lewistown	SPM		8/80		
Gtf-2*	No. of 10th Ave. South	TSP		141	Cascade	Great Falls	SLAMS	1/83	7/80		
Gtf-5	Black Eagle	TSP		141	Cascade	Great Falls	SLAMS	1/83	8/80		

TABLE XVI-C

PRIORITIZED LIST FOR MONITORING STATIONS IN MONTANA

AREA #	NAME OR DESCRIPTION	POLL.	SPECIAL PROJECT FUNDED	AQCR	COUNTY	CITY	STA. TYPE	AUG. 7 F.R. COMPLIANCE DATE	NEW STATION INSTALLATION DATE	SITE MODIFICATION NEEDED	EQUIVALENCY PROBLEM
Kal-2	Evergreen	TSP		144	Flathead	Kalispell	SPM		6/80		
Ana-4	Warm Springs - Hiway 48	TSP		142	Deer Lodge	Warm Springs	SPM		7/80		
Hln-2	Helena Valley	TSP		142	Lewis & Clark	Helena	SPM		7/80		
Kal-3	Idaho & Main Street	CO		144	Flathead	Kalispell	SPM		5/81		
Blg-7	Fairgrounds (Exposition Drive)	SO ₂	X	140	Yellowstone	Billings	SPM		5/80		
Msl-2*	Russell - So. 5th Street	TSP		144	Missoula	Missoula	SPM		7/80		
Bzm-2	So. of West Main	TSP		142	Gallatin	Bozeman	SPM		8/80		
Ram-1*	Tierney Residence	TSP		142	Silver Bow	Ramsay	SLAMS	1/83			
Blg-6	No. Johnson Lane	TSP		140	Yellowstone	Billings	SPM		8/80		
Clf-2*	NAAC (Dehlbom's)	TSP		144	Flathead	Columbia Falls	SLAMS	1/83		X	
Bte-3	Walkerville	TSP		142	Silver Bow	Butte	SPM		9/80		
Bte-4*	Hebgen Park	O ₃	X	142	Silver Bow	Butte	SLAMS	1/83			X
Gtf-4	N.W. of Missouri River	TSP		141	Cascade	Great Falls	SPM		10/80		
Dkr-1*	Decker	TSP	X	140	Bighorn	Decker	SLAMS	1/83		X	
Hrd-1	Westmoreland Area	TSP		140	Bighorn	E. of Hardin	SLAMS	1/83	10/80		
Lnd-1	Lindsay - Wielgosh	MET		143	Dawson	N. of Lindsay	SPM				
Hln-1*	Cogswell Building	TSP		142	Lewis & Clark	Helena	SLAMS	1/83		X	
Mlc-1	Central Miles City	TSP		143	Custer	Miles City	SPM		5/81		
Cus-1	Custer	O ₃		140	Yellowstone	Custer	SPM		4/81		
Lrl-1*	Farm Site	TSP		140	Yellowstone	Laurel	SPM		10/80		
Blg-3*	Bench School	TSP		140	Yellowstone	Billings	SLAMS	1/83			
Gnp-1*	Glacier National Park	TSP	X	141	Glacier	St. Mary	NAMS	1/81			
Blg-10	Central Billings	SO ₂	X	140	Yellowstone	Billings	SPM				
Msl-4*	Rose or Lion's Park	O ₃	X	144	Missoula	Missoula	SLAMS	1/83			X
Msl-4*	Rose or Lion's Park	NO ₂	X	144	Missoula	Missoula	SLAMS	1/83			X
Gtf-3*	No. Kiwanis Park	TSP	X	141	Cascade	Great Falls	SPM				

* - Funding Level I & II stations which receive highest priority, some sites lower on the priority list will, however, operate because they are existing stations.

** - Brackets indicate special funding.

TABLE XVII

DISPOSITION OF UNNEEDED MONITORING STATIONS

Station Name	Site I.D. Number	AQCR	County	City	Pollutant	Shutdown Date	Destination
Lockwood	0080 004	140	Yellowstone	E. Billings ⁴	TSP	8-78	Billings Bench School
Richer	0160 014	142	Silver Bow	Butte	TSP	11-78	Wood Shelter - dispose
Lodge Motel	1400 002	144	Sanders	Thompson Falls	TSP	12-78	Anaconda Mill Creek
"C" Hill	0400 906	142	Deer Lodge	Anaconda	SO ₂	9-79	East Helena
Highway Jct.	0400 004	142	Deer Lodge	Anaconda	SO ₂	9-79	Laurel - Farm
Mill Creek	0400 012	142	Deer Lodge	Anaconda	SO ₂	9-79	Billings S. Park or Taft School
Randall Ranch	1240 009	143	Powder River	Broadus	TSP	10/79	Bozeman
East Station	0720 011	142	Lewis & Clark	E. Helena	SO ₂	9-79	Not Equivalent
Microwave	0760 903	142	Lewis & Clark	E. Helena	Wind	9-79	East Helena
Microwave	0760 903	142	Jefferson	E. Helena	SO ₂	9-79	Not Equivalent
Broudy	0760 904	142	Jefferson	E. Helena	SO ₂	9-79	Not Equivalent
Microwave	0760 903	142	Jefferson	E. Helena	TSP	9-79	East Helena
McKinley	0640 005	142	Granite	Philipsburg	TSP	7-79	Wood Shelter - dispose
Alpine West	0160 015	142	Silver Bow	Butte	CO	6-80	Bozeman
Fire Station #1	0660 009	141	Cascade	Great Falls	TSP	10-80	Gt.Falls-N. 10th Ave.S.
Highway Junction	0400 906	142	Deer Lodge	Anaconda	Wind	11-79	Bozeman-Traphagen
Warren Ranch	0060 010	140	Bighorn	Hardin	TSP		Peabody
McRae	1360 028	143	Rosebud	S.E. of Colstrip	TSP	79	Colstrip
Central Park	0080 059	140	Yellowstone	Billings	O ₃	5-80	Hardin Interchange
Central Park	0080 059	140	Yellowstone	Billings	Wind	7-80	S. Park Taft School
KGHL	0080 007	140	Yellowstone	Billings	TSP	5-80	S. Park-Taft School
Fort Peck	0980 001	143	McCone	Fort Peck	Wind	11-79	Downtown Gt. Falls
Fort Peck	0980 001	143	McCone	Fort Peck	TSP	5-80	Havre
Lame Deer (Fisher-Butte)	1360 003	143	Rosebud	S.E. of Lame Deer	TSP	5-80	Ovando
Hospital Roof	0660 007	141	Cascade	Great Falls	TSP	6-80	Great Falls - downtown
Bonner I	1100 010	144	Missoula	E. of Missoula	TSP	6-80	Courthouse (Co-Lo)
Glendive	0360 001	143	Dawson	E. of Glendive	Wind	7-80	Lindsay
Glendive	0360 001	143	Dawson	E. of Glendive	TSP	7-80	Lewistown
Central Park	0080 059	140	Yellowstone	Billings	NO ₂	8-80	Billings Fairgrounds
Central Park	0080 059	140	Yellowstone	Billings	SO ₂	9-80	Central Billings
Lame Deer (Fisher-Butte)	1360 003	143	Rosebud	S.E. of Lame Deer	Wind	5-80	Russell & Broadway-Ms1a

APPENDICES

<u>Appendix</u>	<u>Title</u>	<u>Page</u>
A.	Maps of Study Areas.	53
B.	Emergency Episode Sites.	76
C.	NAMS Designation.	78
D.	Montana Meteorological Monitoring Guidelines	79
E.	Montana Data Acquisition System.	82
F.	Fine Particulate Sampling. (Dichotomous Samplers)	83

APPENDIX A

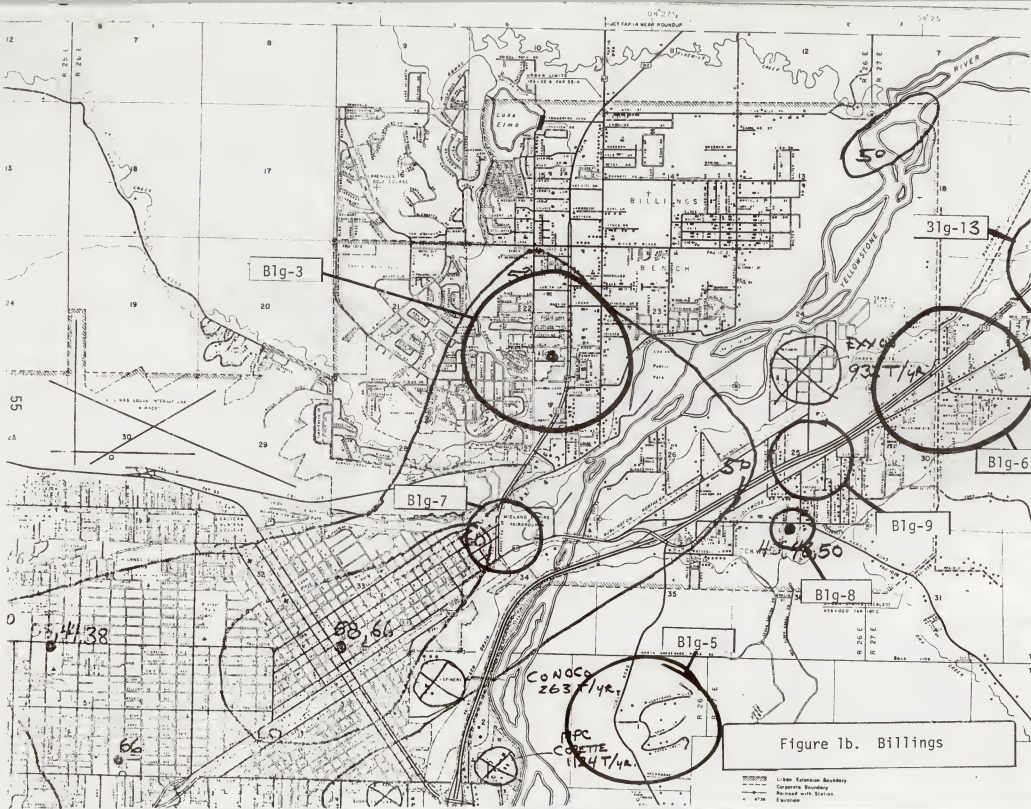
"WORKING" MAPS OF STUDY AREAS

Figure	Title
1	Billings
2	Great Falls
3	Missoula
4	Butte
5	Helena
6	Bozeman
7	Havre
8	Kalispell
9	Anaconda
10	Miles City
11	Lewistown
12	Laurel
13	Libby
14	Columbia Falls
15	East Helena
16	Colstrip
17	State Map - Background Area Types
18	Anaconda - Air Monitoring Stations
19	Anaconda - Suggested Monitoring Areas
20	East Helena - Air Monitoring Stations & Suggested Monitoring Areas
21	Billings - SO ₂ Network

Note: Circles with crosses indicate sources, dots with numbers show 1976, 1977, 1978 TSP annual concentrations, circles with attached labels refer the reader to Tables XV and XVI where pollutants and station types are identified. Isopleth concentrations for TSP are identified on some figures.



Figure 1a. Billings



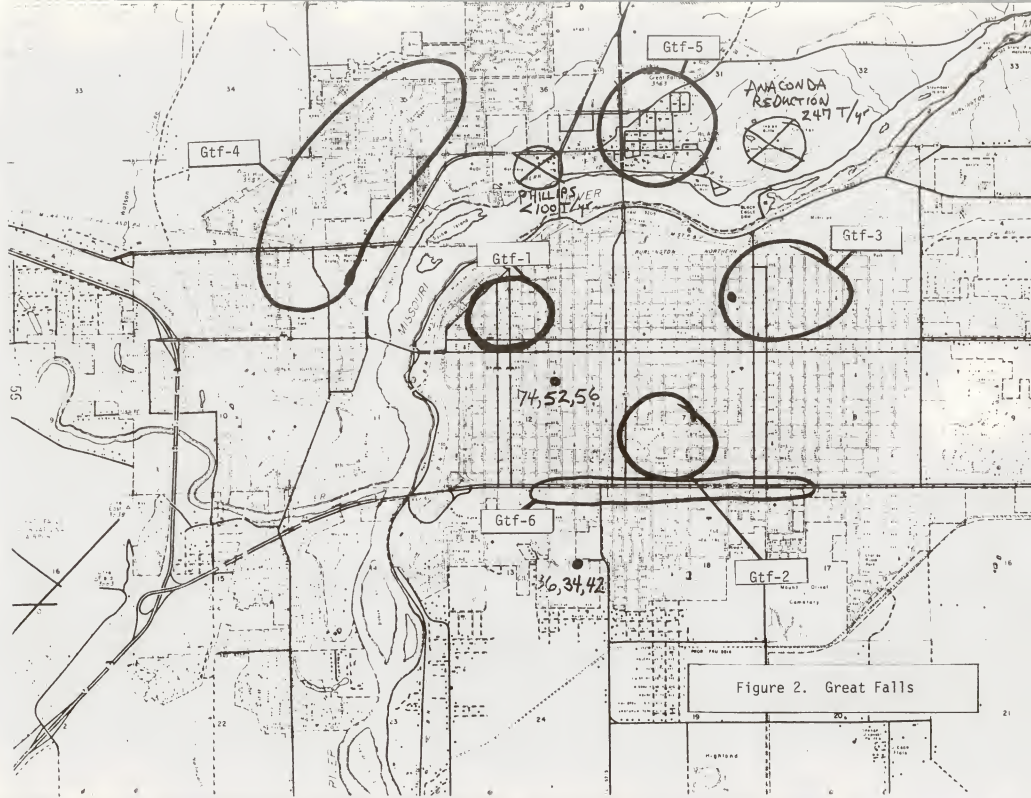
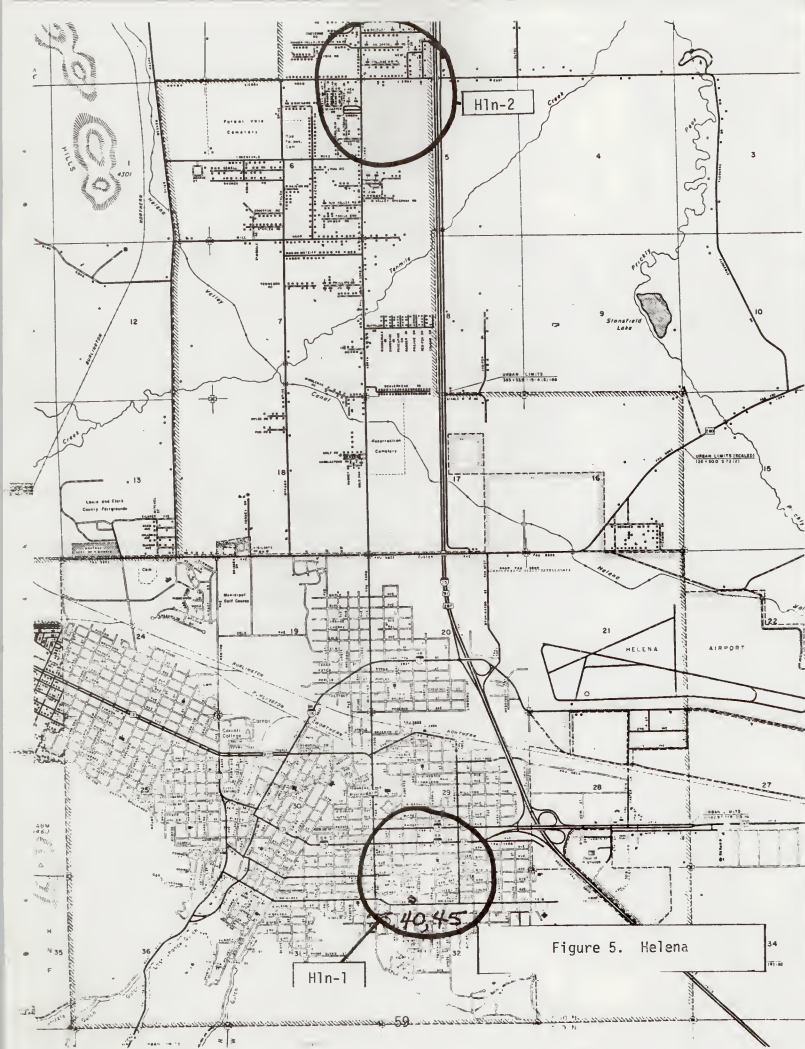
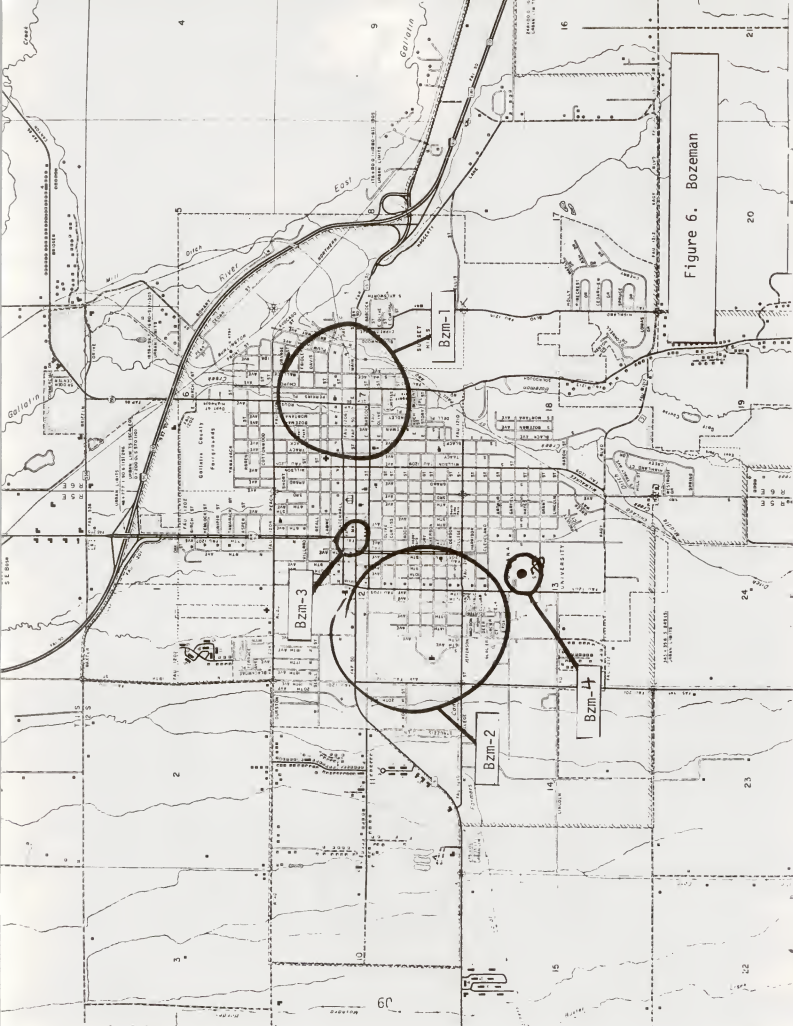
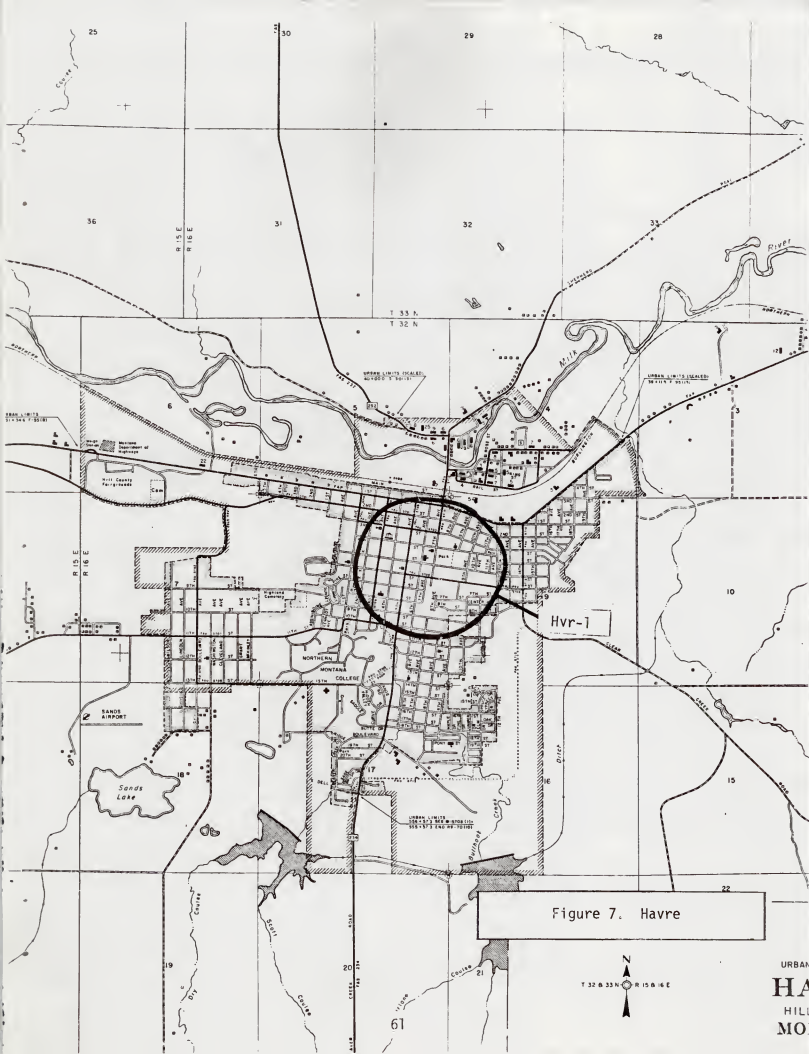


Figure 2. Great Falls









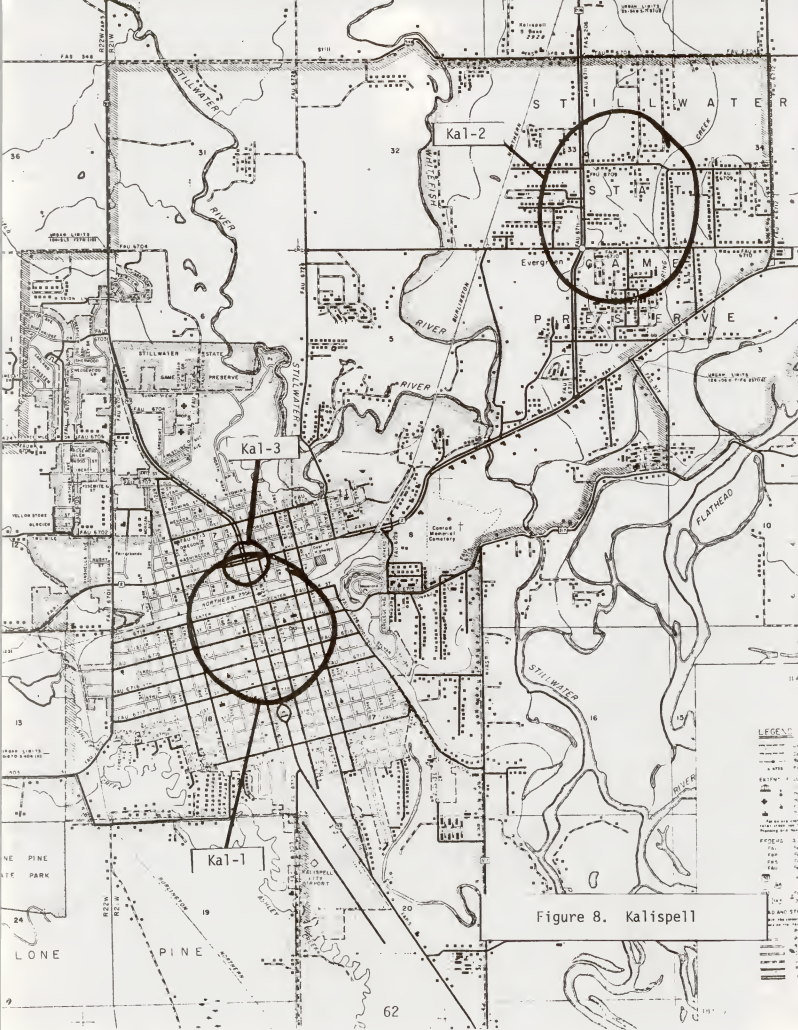


Figure 8. Kalispell

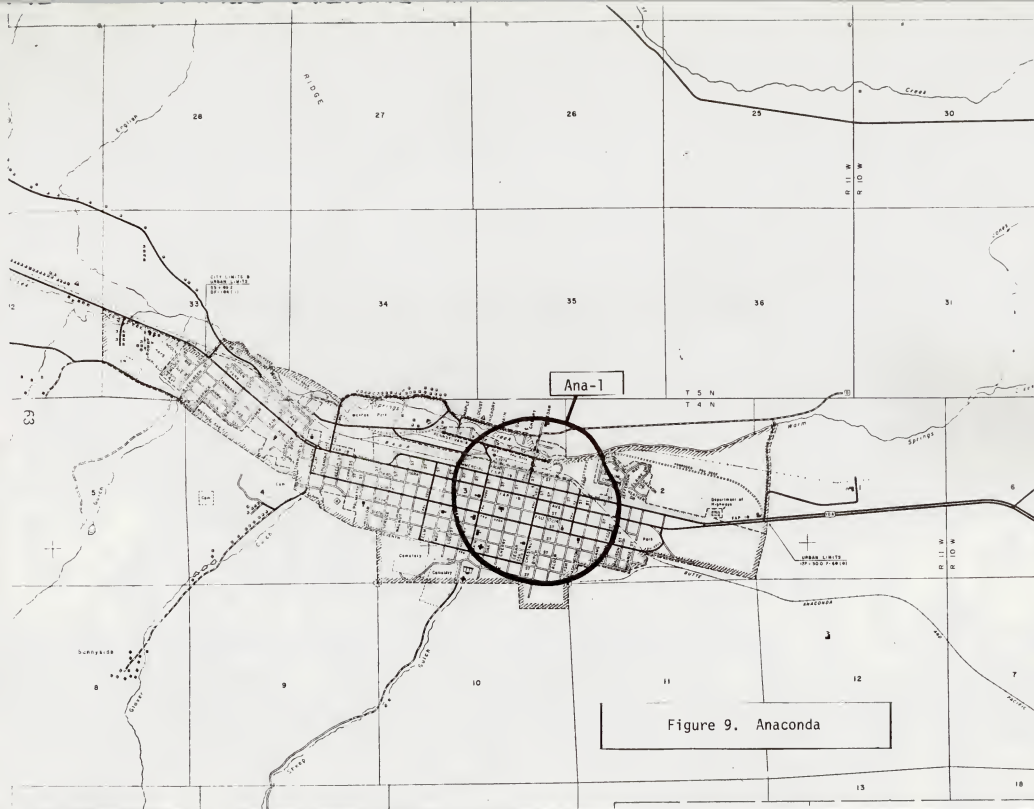
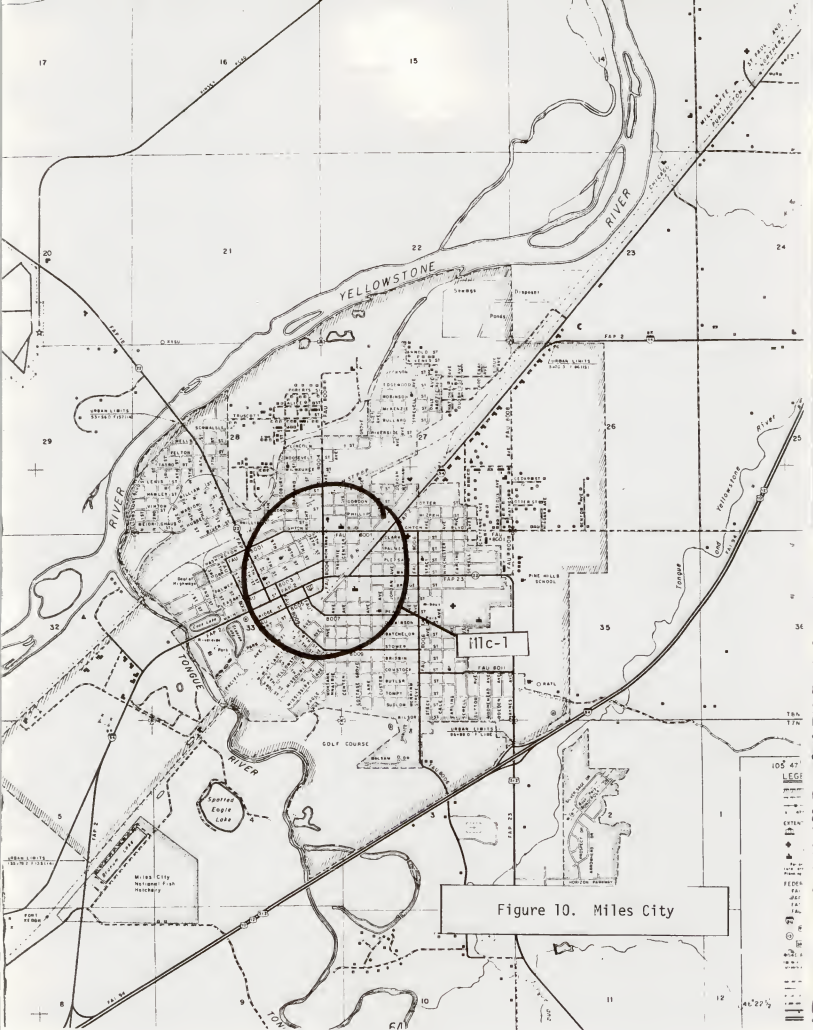


Figure 9. Anaconda



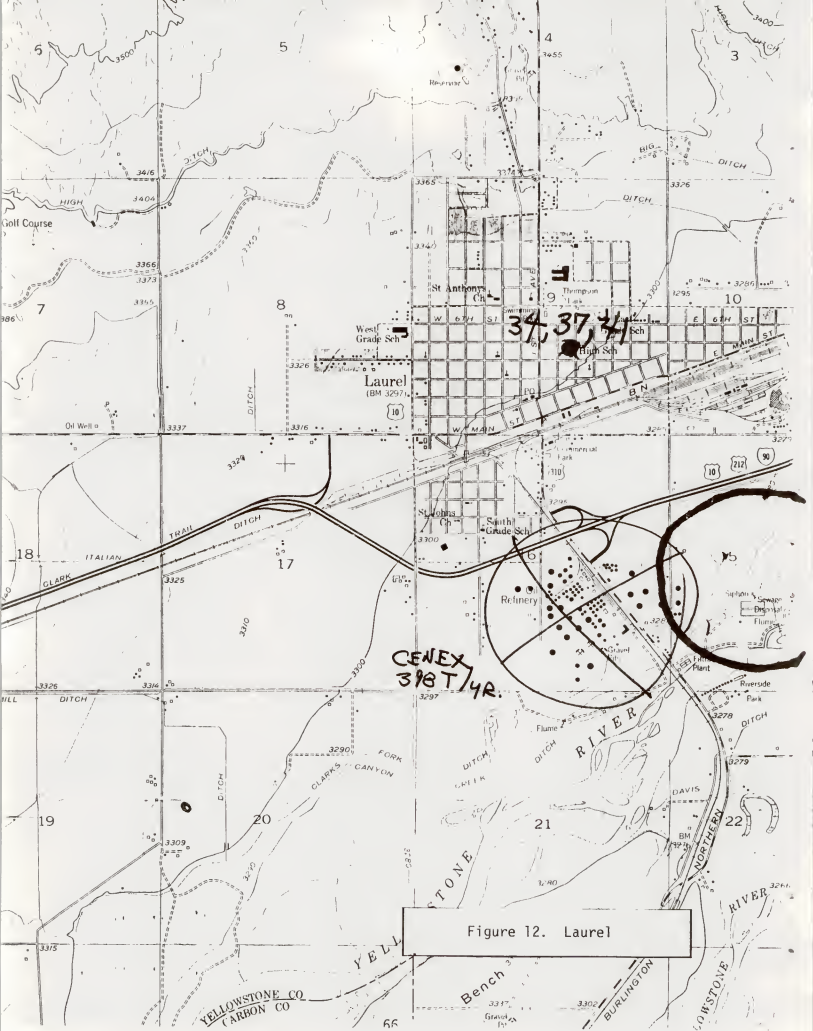
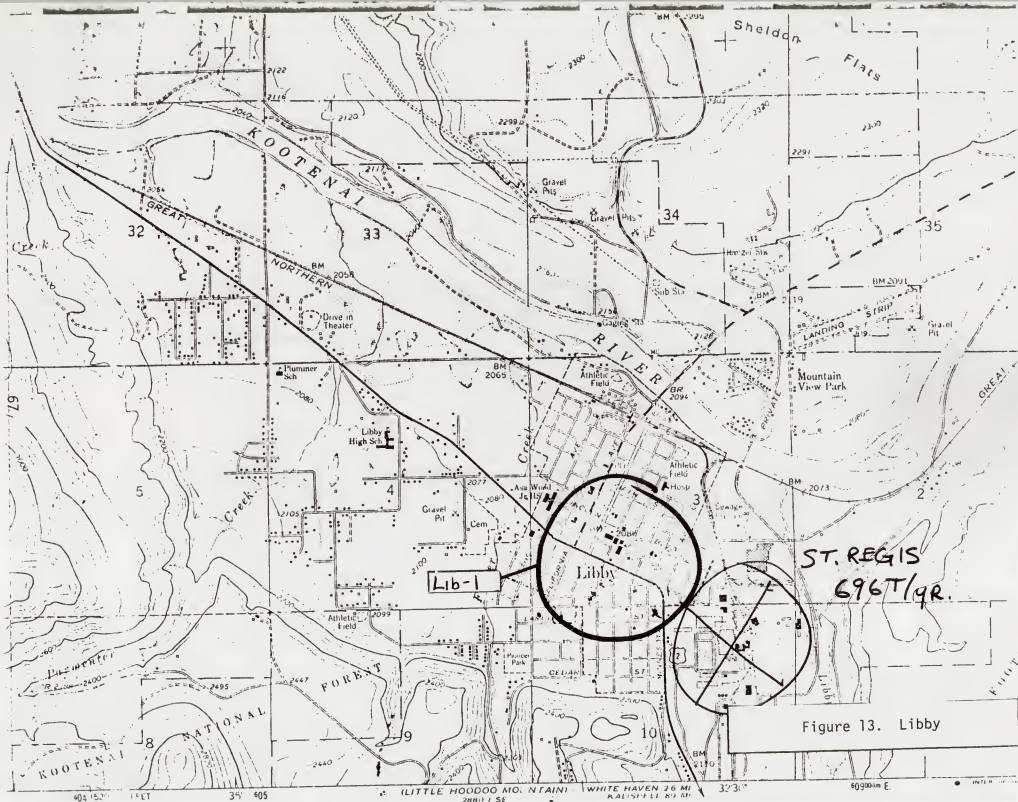
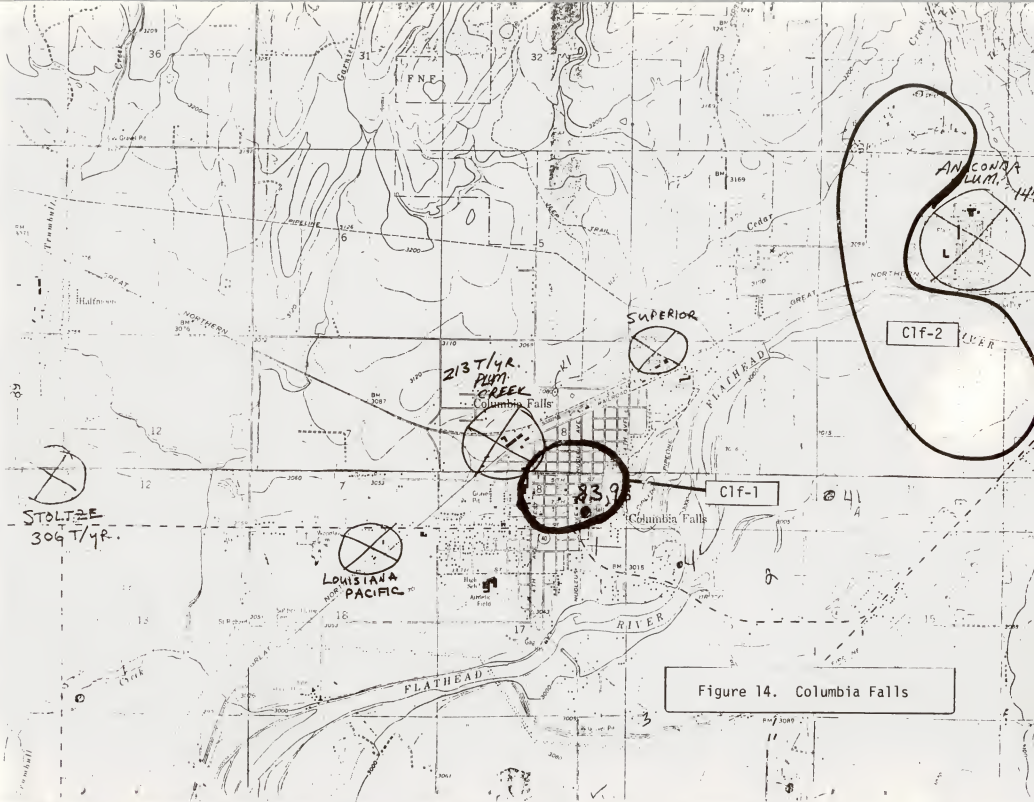
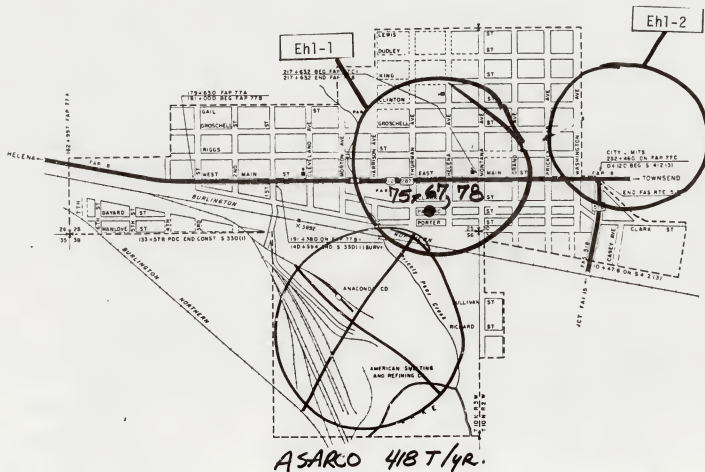


Figure 12. Laurel







CITY PLAT

Figure 15. East Helena

1970 CENSUS 1,651

SCALE IN FEET

0 400 800 1200

REVISED DEC 9, 1978

LEGEND

PROPOSED ROAD
 GRADED AND DRAINED ROAD
 GRAVEL ON STONE ROAD
 LOW TYPE BITUMINOUS ROAD
 PAVED ROAD
 DIVIDED ROAD, TRAFFIC FLOW
 FAS
 FAP

FAS
 INTERSTATE ROUTE MARKER
 U.S. NUMBERED ROUTE MARKER
 STATE ROUTE MARKER
 OTHER ROUTE MARKER
 CORPORATE BOUNDARY LINE
 NON-EXISTENT DEDICATED STREET
 CENTRAL BUSINESS DISTRICT

URBAN EXTENSION BOUNDARY
 RAILROAD AND STATION
 POST OFFICE
 COURT HOUSE
 ELEMENTARY SCHOOL
 HIGH SCHOOL
 HOSPITAL
 ELEVATION



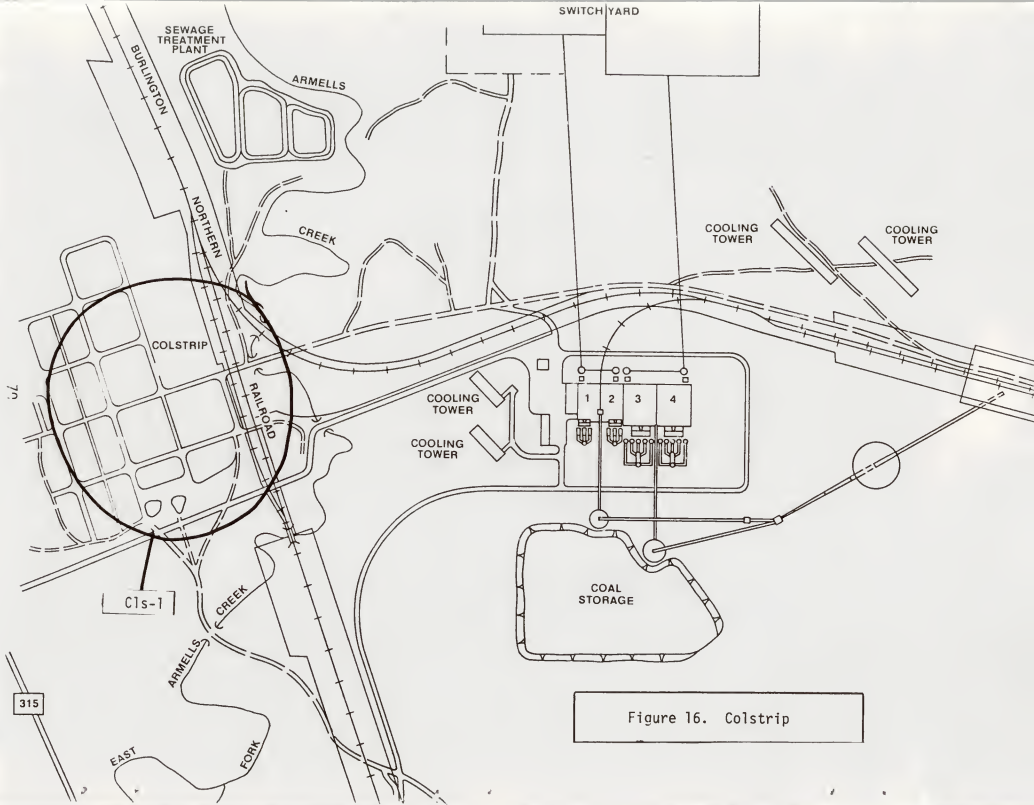


Figure 16. Colstrip

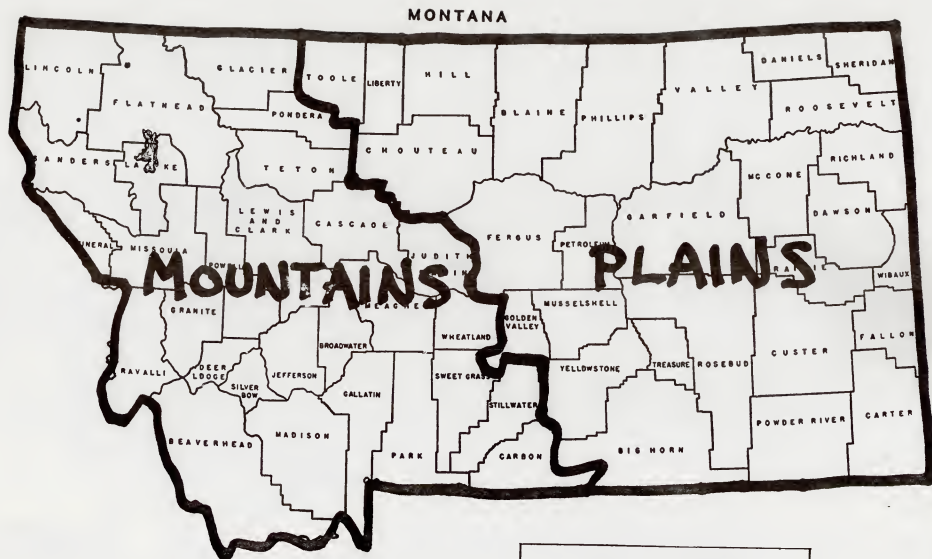
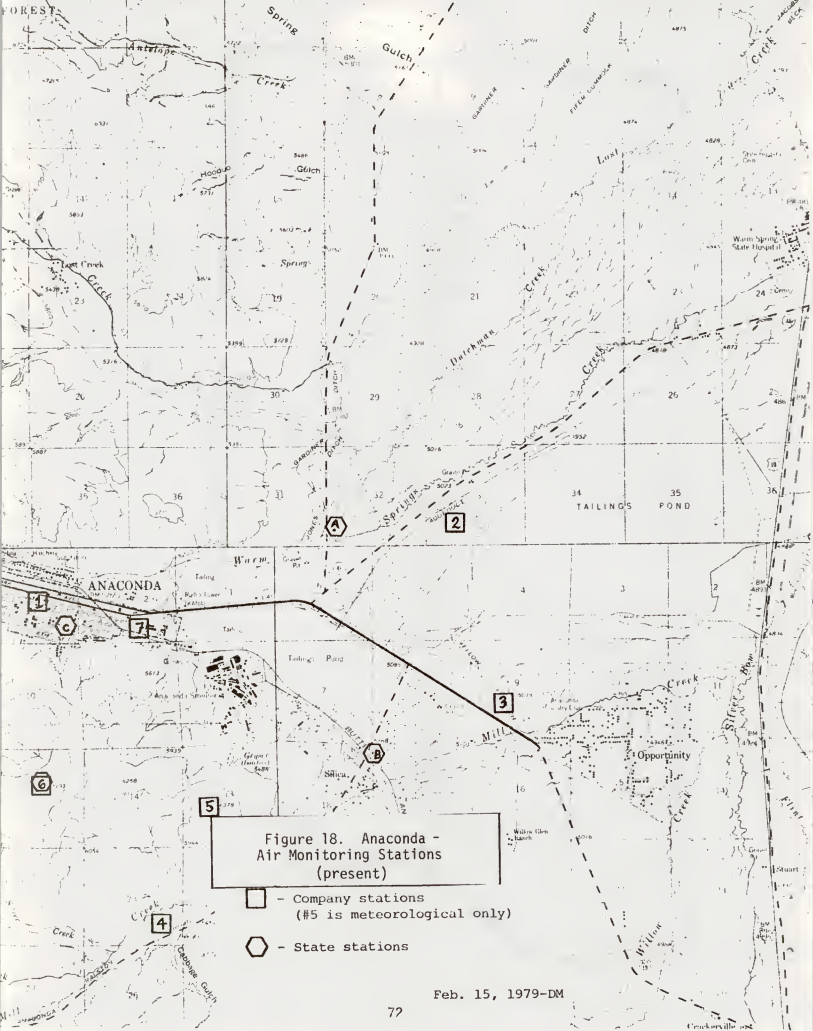
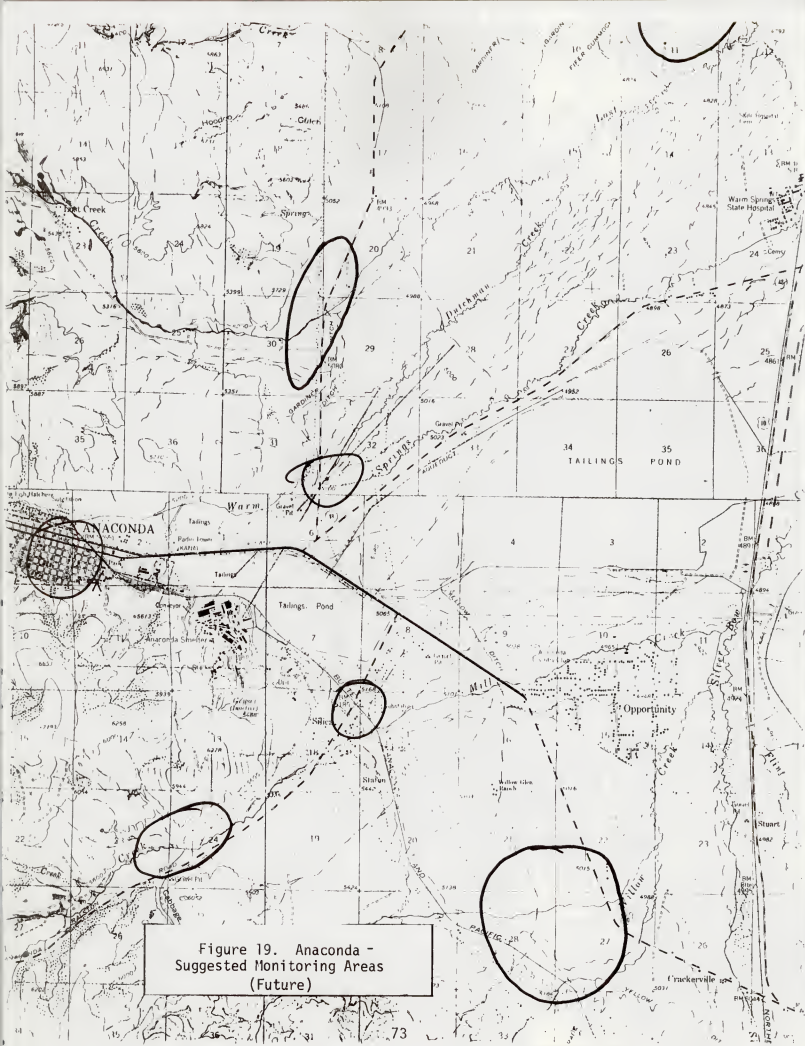


Figure 17. State Map -
Background
Area Types



Feb. 15, 1979-DM



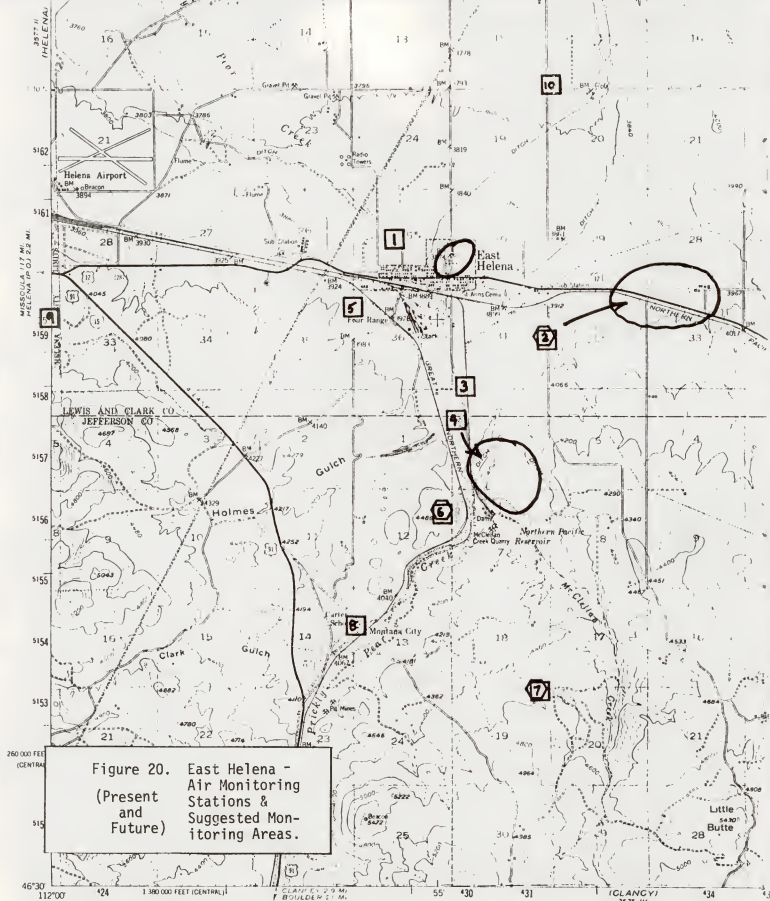


Figure 20. East Helena - Air Monitoring Stations & Suggested Monitoring Areas.

Stereo compilation by Fairchild Aerial Surveys, Inc.
for the Bureau of Reclamation
Field examination and publication by the Geological Survey
as part of the Department of the Interior program
for the development of the Missouri River Basin
Control by USGS and USC&GS
Topography from aerial photographs by stereoplano-graph methods
Aerial photographs taken 1947 Field check 1950
Polycone projection 1927 North American datum

CONTIGUOUS (UNITED STATES) NATIONAL GEOLOGIC VERTICAL DATUM OF 1929

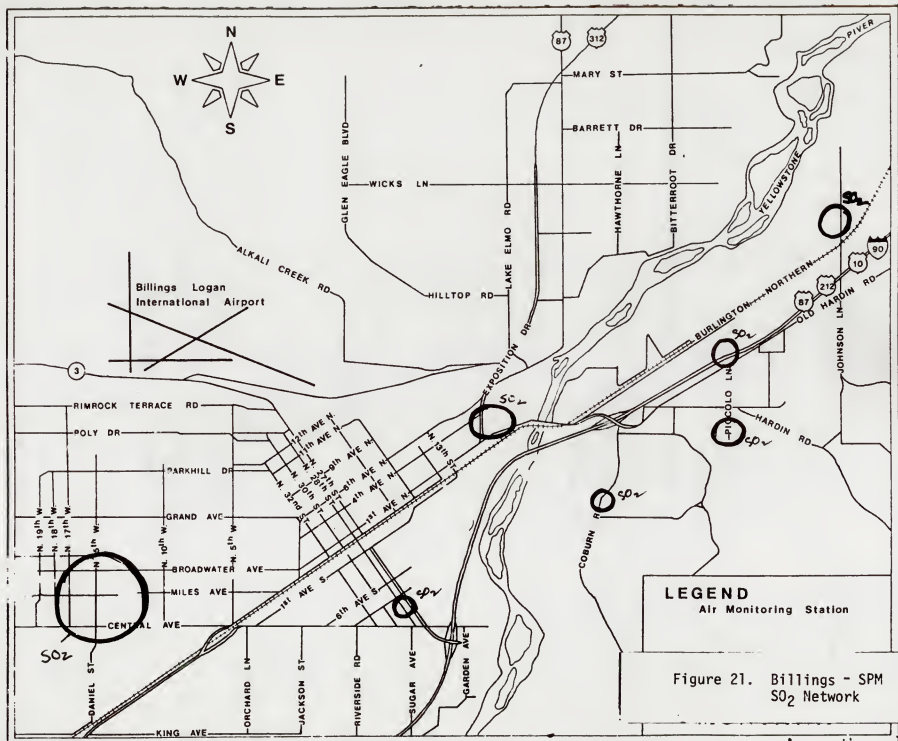


Figure 21. Billings - SPM
SO₂ Network

APPENDIX B

EMERGENCY EPISODE SITES

Certain monitoring stations in areas where high pollutant concentrations can occur are used as emergency episode monitoring sites. For the Anaconda Company, ASARCO, and Missoula, emergency episode plans exist which explain what curtailment actions will be taken when pollutant levels reach harmful concentrations. The control actions are keyed to readings obtained at certain sites.

1. Anaconda - SO₂ designated sites:

Present Plan (Interim Network)

Anaconda Company Stations - #1 - Water Office

#2 - Airport

#3 - Opportunities

#4 - Mill Creek

#6 - "C"-Hill

#7 - Main Gate

State Stations - A - Highway Junction

B - Mill Creek

C - Lincoln School

Note - The company stations are being converted (April-May 1979) to equivalent monitoring methodology stations and have adequate data processing capability. State stations are equivalent but do not meet episode monitoring criteria because automated data handling is not available.

Future Plan - All stations operated by the company will, by AQB agreement, be SPM stations capable of emergency response. The state's Lincoln School SLAM will meet episode needs.

2. East Helena, Montana area SO₂ designated sites:

Present Plan (Interim Network)

The old State and American Smelting and Refinery Company (ASARCo), Saddle Mountain SO₂ stations, and the ASARCo Kennedy Park station were used for episode monitoring purposes but data cannot be received on an hour-by-hour basis. ASARCo operates a very limited intermittent control system.

Present Plan (Interim Network)

ASARCo Stations - Saddle Mountain*

- Kennedy Park

State Station - Saddle Mountain*

*The Saddle Mountain stations were relocated in December 1977 to the Broudy site (# 7 in Figure 20).

Note - ASARCo monitors are EPA-equivalent while state monitors do not meet equivalency. Neither the state nor the company stations presently have adequate data handling capability for emergency episodes.

Future Plan - A new SO₂ state monitoring station east in East Helena will have episode monitoring capability. Company stations must be designated and upgraded for episode purposes and an agreement made with the state for SPM equivalent designation.

APPENDIX C

NAMS DESIGNATION

National Air Monitoring Stations (NAMS) are to be selected from the state network of SLAMS. NAMS are to be located in the most important areas; i.e., areas of highest pollution, areas with a combination of high pollution and high population exposure, etc. In order to meet the needs for NAMS, new sites in Billings and Great Falls must be installed. Existing sites in Missoula and Glacier National Park meet the needs. Table XVIII lists those sites designated as NAMS.

TABLE XVIII
SITES DESIGNATED AS NAMS

<u>Site</u>	<u>Site I.D. #</u>	<u>Pollutant</u>	<u>AQCR</u>	<u>County</u>	<u>City</u>
South Park - Taft School	--	TSP	140	Yellowstone	Billings
South Park - Taft School	--	SO ₂	140	Yellowstone	Billings
Glacier Nat. Park*	0570 001	TSP	141	Glacier	St. Mary
Downtown Great Falls	--	TSP	141	Cascade	Great Falls
Rose Park (or Lion's Park)	1100 020	TSP	144	Missoula	Missoula

*The EPA-operated Glacier National Park station does not fit the criteria for a NAMS station. EPA, however, wishes to designate it for national trend use.

APPENDIX D

MONTANA METEOROLOGICAL MONITORING GUIDELINES

Missoula Area (combination of source and population projects)

1. Obtain on a monthly basis NWS data (CD144)
2. Mixing height measurements using acoustic radar at central location of valley.
3. Surface wind, temperature at location in Missoula and also near Hoerner Waldorf.

Anaconda Area (source project)

1. Each continuous SO_2 monitor should be matched with a surface wind, temperature instrument.
2. Mixing heights should be obtained from an acoustic radar near the south end of the valley.
3. Precipitation should be obtained from the Anaconda Co.
4. Wind fluctuations and vertical temperature gradient should be obtained from Anaconda Co. instruments on C-Hill or Weather Hill.

Butte Area (population and source project)

1. All data should be obtained from MHD on a continuous basis. This includes mixing heights from acoustic radar, wind fluctuations, vertical temperature gradient, precipitation, pressure, temperature, and wind.
2. An additional wind, temperature instrument should be located with each continuous analyzer site.

Helena Area (population and source project)

1. Obtain NWS data on a monthly basis (CD144).
2. Mixing height measurements should be obtained from the ASARCo acoustic radar.

3. Surface wind, temperature should be located with each continuous analyzer.
4. One additional surface wind, temperature should be located near the center of Heiera.

Flathead Valley (special project, later source, population)

1. Present study includes mixing height, NWS data, and four surface wind, temperature systems.
2. Future monitoring should continue to operate acoustic radar near the NWS.
3. NWS data should be obtained monthly (CD144).
4. Surface wind, temperature instruments located in Kalispell, Polson, and Columbia Falls.

Great Falls (population project)

1. NWS upper air and surface data should be obtained monthly.
2. Surface wind, temperature instrument should be located in center of Great Falls (below cliff).

Billings (source, population project)

1. Acoustic radar should be operated on continuous basis.
2. NWS data should be obtained monthly (CD144).
3. Surface wind, temperature should be located with every continuous analyzer.

Colstrip (source project)

1. Montana Power Co. data should be received on monthly basis (computer compatible format).
2. Additional monitoring should include mixing height and each continuous analyzer should be matched with a wind, temperature instrument.

Eastern Montana (background project)

1. NWS data should be obtained from Glasgow and Miles City on a monthly basis (CD144). Upper air data should also be obtained from Glasgow.
2. Mixing height data can be extrapolated from the nearest site unless specific sources are projected, at which time analysis should be made of the source as to the need of additional measurements.

Poplar River (background project soon to be source)

1. NWS data should be obtained monthly from Glasgow (CD144).
2. Mixing heights should be obtained at the Scobey border station through the use of an acoustic radar.
3. Surface wind, temperature should be taken by every continuous analyzer.

Additional Recommendations - Attempts should be made to site wind, temperature sensors capable of remote data access on a continuous basis from mountain tops in the Helena, Kalispell, Missoula, and Butte areas. These measurements can provide useful data on transport winds and lapse rates.

The acoustic radar data must be analyzed on a routine basis.

However, the radar output will require specialized analysis methods which should be planned for.

APPENDIX E

MONTANA DATA ACQUISITION SYSTEM

One of the Bureau's greatest problems has been the timely reduction and analysis of ambient air quality data. To solve this problem the Bureau will perform the following:

1. Helena Central System - A microprocessor-operated system will be installed with limited data handling capability and will "poll" the State's major remote stations once every 24 hours. Some manual editing will be possible before the data is physically transferred to the State's computer facilities. The capability to track episodes will be designed into the system.
2. Field System - A microprocessor-operated field system will be installed at Anaconda, Butte, Missoula, East Helena, Billings, Kalispell, Laurel, and Scobey. Each locally controlled central station will have the ability to handle more than one station in the area.
3. Company System - Company ambient, emission, and meteorological data will be transferred to either the Helena Central or the locally controlled field systems. This step depends on the nature of current and proposed company data systems. Initially, Anaconda and Billings-area data will be received. Agreements will be made with other companies to receive data from East Helena, Colstrip, Missoula, and others.

APPENDIX F

FINE PARTICULATE SAMPLING - (Dichotomous Samplers)

Both hi-vols and dichotomous samplers collect particulate matter in the air. However, dichotomous samplers collect the fine or respirable portion. EPA's research has not identified the method(s) to be used; this information will probably be available in mid 1980. The state has used dichotomous samplers to a limited extent for special projects. Table XIX lists the current locations of dichotomous samplers.

TABLE XIX
LOCATIONS OF DICHOTOMOUS SAMPLERS

Site	Site ID Number	AQCR	County	City
Central Park	0080 059	140	Yellowstone	Billings
No. Kiwanis Park	0660 016	141	Cascade	Great Falls
Hebgen Park	0160 017	142	Silver Bow	Butte
Floral Park Fire Station	0160 020	142	Silver Bow	Butte
Lincoln School	0020 007	142	Deer Lodge	Anaconda
Scobey #1 (Border)	0340 001	143	Daniels	Scobey
Kalispell Airport	0480 304	144	Flathead	Kalispell
Polegridge	0480 035	144	Flathead	Polebridge
Polson (Trussler)	0820 010	144	Lake	Polson
Courthouse Roof	1100 001	144	Missoula	Missoula
McLeod Park	1100 021	144	Missoula	Missoula
Lion's Park	1100 019	144	Missoula	Missoula

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